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DENTITION OF DEVONIAN PTYCTODONTIDÆ.

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THREE genera of Palæozoic Chimæroids, known only by remains of their dentition, constitute the, at present, imperfectly definable family *Ptyctodontidæ*. These are *Ptyctodus*, *Rhynchodus*, and *Palæomylus*, distributed throughout the middle and upper Devonian of Northern Europe and North America. The "jaws," or dental plates as they are more properly called, are rarely well preserved, and invariably occur in the detached condition. The solitary instance of four teeth associated in a group, as noted by Newberry in the type species of Rhynchodus, suggested the inference that in this genus, at least, the upper and lower dental plates were similar, each pair being directly united at the symphysis without the intervention of other teeth or plates. It has likewise been presumed that the dental plates of Ptyctodus were suturally united at the symphysis, but the conformation of this region and distinctions between upper and lower jaws, or even between rights and lefts in the case of detached tritors, have not yet been made out. Neither have dorsal fin-spines, such as occur in most other Chimæroids, been positively established as belonging to this family.

Recently a large amount of new material has come under the writer's observation which throws light on some of these points and prompts the present communication. The bulk of this material was obtained by the writer last summer from the State Quarry fish-bed, as it is called, discovered by Prof. Samuel Calvin in the Devonian of Johnson County, Iowa, and described by him in the seventh volume of the *Iowa Geological Survey Reports* and elsewhere ; for the second source of supply, the best thanks of the writer are due to Messrs. Edgar E. Teller and Charles E. Monroe, of Milwaukee, Wis., who very generously placed their private collections of fossil fishes at the disposal of the Museum of Comparative Zoology, and were influential in securing still further donations. Lastly, the inexhaustible stores of this same museum were drawn upon for a number of undescribed European fish remains, most of which belong to the famous Schultze Collection purchased in 1871. It will be convenient to group the notes which follow under their proper generic headings, beginning with the typical form Ptyctodus.

PTYCTODUS, Pander (1858).

(1) *P. obliquus.* — This, the type species, was illustrated by Pander[1] in two well-executed plates in 1858, as far as the fragmentary Russian material would then permit. Only two of the figured specimens show part of the symphysial region,[2] and these were not unnaturally supposed to indicate a distinct species from the remainder. This mistake, however, was rectified by A. S. Woodward in his *Catalogue of Fossil Fishes*, where a diagrammatic view of the symphysis in the left lower jaw of an imperfect specimen is given.[3] All of Pander's tritors are of the left lower jaw, excepting Figs. 1, 3, and 11, which belong to the right. The orientation of Fig. 6, however, is doubtful.

(2) *P. major.* — A dental plate considerably larger than any

[1] Pander, C. H. *Die Ctenodipterinen des devonischen Systems.* St. Petersburg, 1858.

[2] *Loc. cit.*, Pl. VIII, Figs. 10, 12.

[3] Woodward, A. S. *Catalogue of the Fossil Fishes of the British Museum*, vol. ii, Pt. ii, p. 38. 1891.

of the Russian forms described by Pander, but lacking the symphysis and having the tritoral area imperfect, was made by Rohon the type of a second European species, *P. major*.[1] Apparently the left lower jaw is portrayed in the illustrations, although as far as one may judge from Pl. I, Fig. 2, of Rohon's paper the direction of the tritoral punctæ is forward and outward instead of forward and inward. This character, however, as will presently be shown, is not an infallible clue to the orientation. The same author also mentions the occurrence of certain dorsal fin-spines having a tuberculated ornament, which he thinks may possibly have pertained to this genus.

(3) *P. molaris* (Figs. 28–30). — Yet another European species is that recently figured by the writer under the name of *P. molaris*,[2] from the Devonian of Prüm, in the Eifel District of Rhenish Prussia. The type specimen (Fig. 28) is a very perfect dental plate contained in the Schultze Collection, now the property of the Museum of Comparative Zoology. It represents the left lower jaw and is 6 cm. in length, but at least 1 cm. has been broken away from the posterior end. Its maximum thickness, which occurs just below and behind the tritor, is 1.2 cm. The tritoral punctæ are directed forward and outward, as in *P. major*. The forward portion of the tritoral area has been injured by abrasion, and so, too, has the cutting edge, which extended from the anterior end of the tritor as far as the symphysial beak, a distance of rather less than 2 cm. The tritor itself in this specimen is 2.4 cm. long, and its maximum width .7 cm. The outer face of the jaw is comparatively straight, the inner slightly bowed inward posteriorly. Fine concentric markings having a more or less longitudinal direction, such as occur in all well-preserved Ptyctodus jaws, can with difficulty be made out on both faces, owing to an adventitious glaze which covers the fossil.

This specimen has the anterior portion exceptionally well preserved. The front margin is slightly rounded, extends upward to form a strong prehensile beak, and also projects

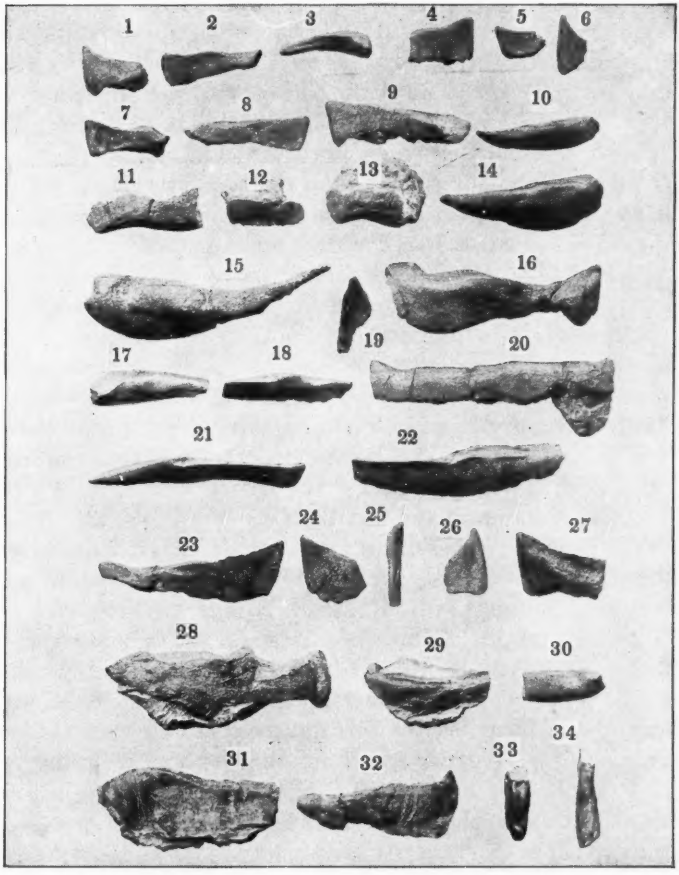
[1] Rohon, J. V. Beitrag zur Kenntnis der Gattung Ptyctodus, *Verhandl. mineral. Gesellsch. St. Petersburg* [2], vol. xxxiii (1895), pp. 1–16.

[2] *Ann. Rep. Iowa Geological Survey*, vol. vii (1897), p. 115, Fig. 10 *B*.

downward below the general level of the base, so as to provide a solid basis of attachment with its counterpart on the right side of the jaw. Distinct traces of this symphysial attachment are seen on the inner face in the form of a beveled band 4 mm. wide, running parallel with the front margin (see Fig. 28). There is no thickening on the inner face of the jaw at the symphysis, and in consequence the two upper dental plates must have been in close proximity to each other throughout the anterior portion of their length, in order to have permitted the beaks of the lower jaw to bite outside of them, which we know from other species must have happened. Although an excavated area appears on the outer face of the specimen behind the beak and below the cutting edge, yet this is plainly not due to wear, the boundaries being too sharply demarcated for that, and is therefore to be regarded as the natural configuration of this region in the present species. Other species, however, so far as known, have the outer face perfectly smooth, all traces of wear against the upper dental plate being confined to the inner side of the cutting edge. No upper jaws referable to this or any other European species have yet been encountered, but detached tritors are not uncommon.

(4) *P. calceolus* (Figs. 1–17). — This well-known species, the only one yet described from this country, is tolerably abundant in the Hamilton Limestone of the Upper Mississippi Valley and Manitoba ; but prior to the discovery of the State Quarry fauna, near North Liberty, Iowa, was never met with except in a fragmentary condition. The reason for this is because the tissue surrounding and in advance of the tritors is vascular and soft ; besides this the dental plates are considerably attenuated between the tritor and symphysial beak, and hence are extremely liable to be broken here through destructive agencies. Detached symphyses occur in the State Quarry bed, to be sure, but are vastly outnumbered by separate and, for the most part, abraded tritors. Out of more than 5000 specimens of Ptyctodus collected at this locality only about 50 showed the symphysial region, and of these but four belonged to the upper jaw. Approximately perfect dental plates are therefore of the utmost rarity.

The largest complete dental plate belonging to this species that the writer has seen is that shown in Fig. 15; it is about



FIGS. 1–17. — *Ptyctodus calceolus*, N. and W. Figs. 18–27. — *P. compressus*, sp nov. Figs. 28–30. — *P. molaris*, Eastman. Figs. 31–34. — *P. panderi*, sp. nov. × ½.

7 cm. in length and 1.5 cm. in maximum width. The tritoral area measures 3 × .8 cm., and the anterior cutting edge is about two-thirds as long as the tritor. The specimen shown in Fig. 16 is 5.5 cm. long; that figured in the preliminary

paper on the State Quarry fauna already referred to[1] represents an average-sized individual 4.5 cm. in length. Upper dental plates (Figs. 12, 13), as far as their characters can be made out from the meager material at hand, do not differ materially from those described below as *P. ferox*, excepting, of course, that they are smaller, and are conformable to the lower jaw in curvature. The following remarks are, therefore, to be understood as applying exclusively to the lower dental plates.

Viewed from above, the curvature of the lower dental plates is seen to be more or less sigmoidal, the median line being in the left ramus *f*-shaped, and in the right ſ-shaped. The outer face is usually straighter and more nearly vertical than the inner. Very frequently the bony tissue enclosing the tritor is thickened so as to form a slight convexity on the inner posterior face, and its outline sweeps around posteriorly as an independent curve beyond the median line of the tritor, until it finally becomes merged with the less-rounded outer face of the jaw. The intersection of these curved outlines forms superiorly a peaked ridge just behind the tritoral area (Figs. 3, 16, 17) ; and it is to be noted that this ridge always lies externally to the median line of the tritor, or, to express it differently, the tritoral area tapers posteriorly toward the inside wall of the jaw, and is nearer to that side than the outer.

The tritoral area occupies nearly the full width of the upper surface of the jaw and partakes of the same curvature. Starting from behind, it curves first inwardly for about one-half its length, and then reverses this direction so that the anterior extremity tapers outward, and as the more arcuate boundary obviously lies on the inner face of the jaw, we are furnished with a convenient clue to the orientation in the case of detached tritors. In general, the parallel laminæ, or rows of punctate which indicate them superficially, are directed forward and inward, but exceptions to this rule are not uncommon, owing to irregularities in the arrangement of the medullary canals and inequal wearing away of the triturating surface. The latter cause is a powerful determinant in affecting the superior aspect of the tritors.

[1] *Ann. Rep. Iowa Geological Survey*, vol. vii (1897), p. 115, Fig. 10 *A*.

Just in front of the tritors the jaw is constricted, the inner face bending in close to the outer, which remains nearly straight, or may even curve slightly outward. Young forms have the constriction less marked than adults, since it becomes still further narrowed through wear. As already remarked, the outer face, which continues nearly vertical and smooth in advance of the tritors and terminates superiorly in a knife-edge, clearly never came in contact with the opposing upper dentition, since all evidences of wear are confined to the inner face. Young forms have a relatively shorter cutting edge than full-grown individuals, indicating that the symphysis became pushed further forward with age. The cutting edge slopes rapidly upward in front and terminates in a sharp prehensile beak. Below, at the symphysis, there is a projection similar to that noticed in *P. molaris*, for the purpose of strengthening the symphysial attachment ; and the front margin joining these two projections is straight, or very nearly so, instead of convex as in the European species. The inner face of the symphysis is thickened and rounded in order to separate the rami sufficiently to close outside the upper dental plates. Two vertical lines sometimes appear near the front margin in well-preserved specimens, and include between them a wedge-shaped area having apparently a denser structure than the surrounding tissue. No beveling has yet been observed on any of the specimens to indicate a sutural union at the symphysis. Either such traces have been effaced by accident, or the dental plates were simply apposed and held in place by ligaments. Illustrations of the symphysial region in different specimens are given in the accompanying figures.

(5) *P. compressus*, sp. nov. (Figs. 18–27). — Besides *P. calceolus*, two new species occur, although in lesser profusion, in the State Quarry bed, and one of them is found also in the Hamilton Limestone of Milwaukee. These new forms, which we will call *P. compressus* and *P. ferox*, are interesting on account of being transitional to the genera Rhynchodus and Palæomylus, respectively. The tritors in *P. compressus* are relatively narrower and longer than in *P. calceolus*, and between them and the symphysis a long, sharp, cutting edge is formed

by the lateral wall of the jaw. In all other species the knife-edge is shorter than the tritoral area, but in the present form the cutting edge is never shorter, and may be as much as one-fourth longer than the tritors. In the lower jaw it is the outside and in the upper the inside wall which is thus sharpened into a razor edge. As a whole, the jaws are straighter than in *P. calceolus*, and the symphysial region differently formed, as is apparent from the figures given herewith, the originals of which are preserved in the Museum of Comparative Zoology, and were all collected by the writer near North Liberty, Iowa.

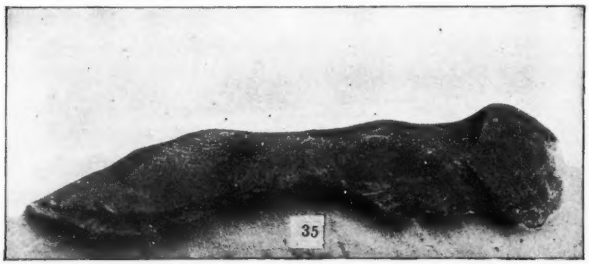


FIG. 35. — *Ptyctodus ferox*, sp. nov. Left upper dental plate. × ¼.

(6) *P. ferox*, sp. nov. (Figs. 35–40). — Much larger, heavier, and rarer than any of the foregoing is the species which we will call by this name. Less than a dozen examples have been obtained, all told, from the two localities where they occur, namely, the State Quarry fish-bed and the Hydraulic Cement quarries of Milwaukee, Wis. Those from the latter horizon are exceptionally well preserved, and were obtained by Messrs. Teller and Monroe. One of the four upper dental plates in Mr. Teller's collection (shown in Fig. 35) was very kindly presented by him to the Museum of Comparative Zoology, and is taken as the type of this species. Two other specimens in Mr. Teller's collection exceed this in size, one of them, measuring 11.5 cm. in a straight line, joining the extremities on a level with the triturating surface. The total length is estimated to have been about 14 cm.

This species illustrates the differences between upper and lower dental plates most admirably, and is, in fact, the first in

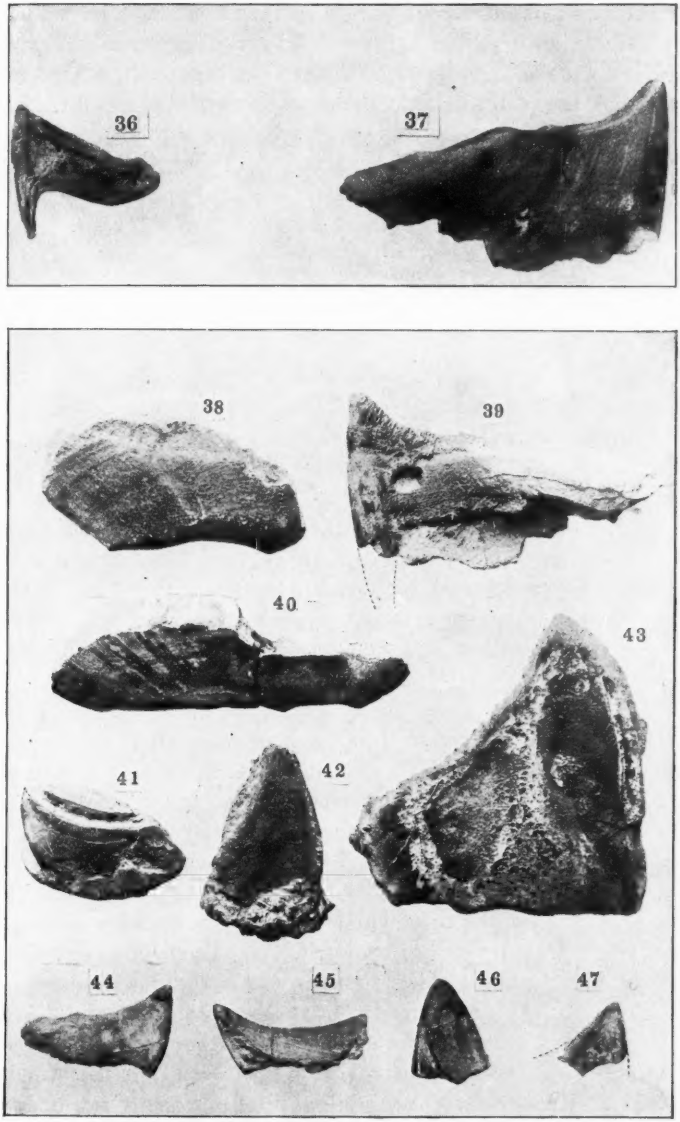
which these distinctions have been made out. The tritoral area of the upper jaw terminates anteriorly in a slight prominence or tubercle, situated somewhat nearer the outside than the inside face, and from this point onward as far as the crest of the symphysis a decided beveling is seen along the outer face (Fig. 35) where the beak of the lower jaw played against it. With increasing wear the beveling becomes converted into an excavation, the appearances suggesting that the jaws were movable, not only in a vertical, but also to some extent in an antero-posterior, direction.

Anteriorly, the upper dental plates project forward and upward in a gently curved line, obviously for the purpose of strengthening the symphysial attachment, and they are also bent inwardly toward the front. As the inner face is but slightly thickened at the symphysis, the upper dental plates must have been more closely approximated anteriorly than the lower, thus permitting the prehensile beaks of the latter to pass by them on the outside, and allowing the cutting edge to close like the blade of a pair of shears. It is also plain that the rami of both jaws must have met at a rather acute angle anteriorly, forming a narrow V. The upper dental plates have a slight sigmoidal curvature, the posterior end flaring out and the symphysial portion being inflected inward.

The lower dental plate in this species is remarkable chiefly for its great height along the anterior margin, general straightness in an antero-posterior direction, and powerful prehensile beak. Superficially, it is marked by fine concentric striæ similar to those in Palæomylus, directed more or less parallel to the triturating surface and running at right angles to the second set commonly found in species of Ptyctodus. Four examples of the lower dental plate have come under the writer's observation, one of which is unusually heavy and corresponds in size to the largest of the upper dental plates. A medium and a small-sized individual are shown in Figs. 36, 37, and 39, the last two presenting the inner and outer aspects, respectively, of the same specimen. The original of Fig. 36 was found by Mr. C. E. Monroe near Milwaukee, and is preserved in his private collection. It represents a comparatively young indi-

vidual, being much smaller, thinner, and less worn on the triturating surface than Mr. Teller's specimens. Very remarkable indeed is the spiniform projection at the symphysis, which depends for such a distance inferiorly that the front margin actually exceeds the triturating surface in length. To give precise data, the total length in an antero-posterior direction is 3.4 cm. ; length of triturating surface, 2.6 cm. (tritor, 1.5, cutting edge, 1.1) ; of anterior margin, 2.9 ; maximum thickness (width), 0.3 cm. Viewed from above, the curvature is seen to be only slightly sigmoidal and there is scarcely any thickening on the inner face at the symphysis. The tritoral punctæ are transversely directed, and the longitudinal ridge just back of the tritor nearly coincides with the median line. As is invariably the rule, beveling due to wear is confined to the inner face of the cutting edge.

The original of Figs. 37 and 39 belongs to Mr. Teller. Its outer wall is nearly straight for the greater portion of its length, but curves gently outward in advance of the tritoral area. This outward curvature is more strongly marked in another of Mr. Teller's specimens, recalling that shown in Fig. 3. Below the cutting edge, in about the center of the bony substance forming the outer wall of the jaw, is to be seen a circular pit or indentation 0.5 cm. in diameter and 0.2 cm. deep (see Fig. 39) ; and as a similar depression occurs in the same region of another specimen, the outlines being quite regular in both, it appears to have been a natural cavity. All of the lower dental plates have an uneven grinding surface, the principal slope being downward and outward. Other species have the slope usually downward and inward. The tritoral punctæ are nearly transverse in their direction, with a tendency toward forward and inward posteriorly. This is contrary to the conditions in the upper dental plates, which have the punctæ directed forward and outward. The original of Fig. 37 shows two vertical lines on the inner face of the symphysis which bound an area of apparently denser structure than the surrounding tissue and has a separate system of vascular canals. The thickening at this region has been reduced through abrasion, but it is seen from another specimen that a vertical triangular depression



FIGS. 36–40. — *Ptyctodus ferox*, sp. nov. Figs. 41, 44–47. — *Rhynchodus rostratus*, sp. nov. Fig. 42. — *Rhynchodus major*, sp. nov. Fig. 43. — *Palæomylus predator*, sp. nov.

extended along the front margin on the inner side, very similar to that shown in the figures of Rhynchodus given herewith (Figs. 45, 46). Evidently, it lodged cartilage or ligaments for holding the plates firmly together at the symphysis.

From the foregoing account it will be seen that the general aspect of this species is suggestive of Palæomylus, which differs from Ptyctodus in having a much heavier and wider symphysial area, and is without definite tritors. That it forms a connecting link between these two genera we cannot doubt for a moment.

(7) *P. panderi*, sp. nov. (Figs. 31–34). — The type of this species, shown in Fig. 32, is contained in the Schultze Collection of the Museum of Comparative Zoology, along with about fifteen less perfect dental plates, tritors, or detached symphyses. According to a MS. label in German script, these specimens were obtained through a collector named Kröffges in 1859, and came from the Devonian of Berndorf and Gerolstein in the Eifel District. Evidently their description was at one time intended (perhaps by Hermann von Meyer, who had access to part of this collection), for they are marked with the MS. name of "*Ptyctodus panderi*, n. sp." This name may very appropriately be retained and validity given to it by the following brief diagnosis.

P. panderi, a species accompanying *P. molaris* in the Eifel Devonian, and related to it in the same way that *P. compressus* is to *P. calceolus*. Lower dental plates attaining a length of 6 cm., but commonly not more than 4 cm., and in height about 1.5 cm., with only a very slight sigmoidal curvature in an antero-posterior direction, and strongly compressed laterally. Outer face forms superiorly a sharp, nearly straight knife-edge extending from the tritoral area to the anterior beak, a distance of about equal length with the tritors. The cutting edge rises very slightly and suddenly to form the anterior projection, below which the anterior margin is moderately convex. With scarcely any thickening on inner face at the symphysis, and inferior projection at this region not observed (perhaps wanting?). Upper dental plates likewise thin and nearly rectilinear. This species forms with *P. compressus*, from which it differs

principally in the configuration of the symphysial area, a transitional stage between *Ptyctodus* and the next following genus.

Rhynchodus, Newberry (1873).

(1) *R. secans.* — This species, which is the type of the genus, is not uncommon in the Corniferous Limestone of Ohio, and is interesting for having furnished a group of four teeth preserved in natural association. There is but little difference in the form of upper and lower dental plates, and both terminate anteriorly in prominent beaks. It is probable that the latter character is not merely specific but generic, as *R. excavatus* also has sharp beak-like projections in both jaws. An indentation occurs just back of the beak in the upper jaw where the terminal point of the lower came in contact with it, thus proving that the upper jaw protruded forward in advance of the lower, as in Ptyctodus. The lower dental plate is deeper than the upper, which was limited vertically by the cranial wall, and its triturating surface is frequently more uneven. Its inner face is beveled away through contact with the upper jaw, the two working together like blades of shears.

A knowledge of this latter character compels us to dissent from Newberry's determination of one of his figures[1] as a "left maxillary tooth" in spite of its having a nearly straight cutting edge. Owing to the fact that it is beveled on the inner face and is not cut away behind the anterior beak we prefer to regard it as the right lower dental plate.

(2) *R. occidentalis.* — This species has never been figured, and the writer has been unable to obtain examples of it. Newberry's original description is as follows[2]: "Teeth of small size, much compressed. Anterior margin slightly curved, but nearly vertical. Superior margin gently arched downward from the prominent anterior point, forming a much-compressed triturating surface or edge. Posterior portion of upper margin acute-edged. Exterior lateral surface striated obliquely backward.

[1] Newberry, J. S. *Rep. Geol. Surv. Ohio*, vol. i, Pt. ii (Paleontology), Pl. XXVIII, Fig. 1 (1873). Also figured in *Mon. U. S. Geol. Surv.*, vol. xvi (1889), same number of plate and figure.

[2] *Annals N. Y. Acad. Science*, vol. i (1878), p. 192.

Basal margin formed by the edges of external and internal laminæ, of which the edges are broken and irregular. From the Hamilton Limestone, Waverly, Iowa."

(3) *R. excavatus.* — Our knowledge of this species is confined to the single imperfect dental plate described by Newberry,[1] and recognized by him as belonging to the left ramus of the lower jaw. Perfectly preserved specimens are very rare, it would seem, as most of the material collected by Messrs. Teller, Monroe, and Slocum from the Cement quarries of Milwaukee are deficient to a greater or lesser extent.

As far as can be learned from the materials at hand, only the lower dental plates are excavated along the cutting edge in the manner described by Newberry, and the sinus varies somewhat in length among different individuals. The lower jaw is further characterized by having an inferior projection at the symphysis, as in Ptyctodus. It is greatly prolonged downward, being, in fact, spiniform, and recalling the conditions in *P. ferox;* in one of Mr. Monroe's specimens it occupies fully half of the front margin. Of what practical advantage such a contrivance could be it is difficult to perceive. Vermiculating furrows do not occur on the surface of well-preserved specimens, but may be sometimes brought out through corrosion or abrasion. The outer surface is normally smooth, or is marked only with very fine concentric striæ.

Lower dental plates have the cutting edge beveled off on the inner face only. Upper dental plates show distinct traces of wear on the outer face, which terminate abruptly, however, at a slight distance behind the anterior beak. This proves that the beaks in upper and lower jaws were not directly opposed to one another, but those of the upper protruded in front of the lower when the mouth was closed. We are led to infer from the conditions in *R. secans* that the beaks in both jaws were more or less similar, but as none of the upper beaks are completely preserved in the material at hand, this inference must remain for the present unconfirmed. The cutting edge

[1] *Rep. Geol. Surv. Wisconsin*, vol. ii (1877), p. 397. *Annals N.Y. Acad. Science*, vol. i (1878), p. 192. *Mon. U.S. Geol. Surv.*, vol. xvi (1889), p. 50, Pl. XXIX, Fig. 1.

of the upper dental plate is remarkably straight and sharp. None of the specimens appear to have exceeded 5 cm. in length.

(4) *R. rostratus*, sp. nov. (Figs. 41, 44–47). — The characters of this species, as determined from nearly a score of dental plates in the Schultze Collection in the Museum of Comparative Zoology, are as follows: Lower dental plates attaining a length of about 6 cm. and a height of about 2 cm.; perfectly straight, laterally compressed, smooth and glistening externally, or with only very fine concentric striæ. Superior margin semicircular or nearly so, being concave upward; front margin regularly convex and terminating above in a sharp projecting beak. Cutting edge occupying nearly the entire superior margin, very sharp, and beveled on the inner face through wear. Inner face slightly thickened at the symphysis, but never wider than 0.5 cm., otherwise plane like the outer. A peculiar lanceolate or tongue-shaped cavity, having the apex directed superiorly, occurs on the lower half of the symphysial area; its roughened surface suggests that it served for the reception of ligaments which held the two rami together at the symphysis. Upper dental plates unknown.

Two rather imperfect specimens in the Schultze Collection are interesting from having been figured by Hermann von Meyer,[1] under the mistaken impression that they were swimming appendages of his so-called "Physichthys Höninghausi." All the originals on which his descriptions were based are preserved in the Cambridge Museum, and obviously belong to the three genera, Macropetalichthys, Pterichthys, and Rhynchodus, as was first pointed out by A. S. Woodward[2] a few years ago.

This species is known at present only from the Eifel Devonian, the Cambridge specimens having been found at Pelm, Gerolstein, and Berndorf.

(5) *R. major*, sp. nov. (Fig. 42). — This form accompanies the preceding in the Eifel Devonian, the typical locality being Prüm. Complete dental plates have not been recovered as yet,

[1] Meyer, von, H. Physichthys Höninghausi, etc., *Palæontographica*, vol. iv (1856), Pl. XV, Figs. 9, 10.

[2] *Geol. Magazine*, [3] vol. vii (1890), p. 459.

but two large-sized fragments in the Schultze Collection furnish sufficient evidence of a distinct species. They indicate a jaw of about twice the size of *R. rostratus*, and are heavier in proportion. Concentric striæ are more prominent than in the last-named species, and one of the specimens shows minute folds crossing the striæ at right angles. These have the appearance of fine cracks on the gently rounded anterior margin where they have been somewhat corroded. The symphysis is constituted similarly to that of the preceding species. The eighteen or more examples of *R. rostratus* in the collection are too nearly of a size to be regarded as all young forms, of which *P. major* is the adult, and it would be strange indeed if full-grown individuals were outnumbered ten to one by more readily destructible immature examples. Close resemblances exist, however, between the anterior regions of *R. rostratus*, the present species, and *Palæomylus predator* (Fig. 43).

(*To be continued.*)

A LIST OF THE MAMMALS OF LABRADOR.

OUTRAM BANGS.

In the *Geological Survey of Canada*, Annual Report, New Series, vol. viii, 1895, pp. 313 L. to 321 L., Mr. A. P. Low gives a "List of Mammalia of the Labrador Peninsula, with brief notes on their distribution, etc." This list, appearing as it does in Mr. Low's valuable report upon Labrador, and being based very largely upon his personal observations in the field, is of great importance, and it is much to be regretted that so many of the names used are archaic — often misleading. The volume did not appear until the summer of 1897, although probably Mr. Low's list was written some time before that. The list, however, does not include several Labrador mammals, descriptions of which had appeared in print prior to 1895.

It is with such corrections and additions that I deal principally in the present paper, endeavoring to bring Mr. Low's list up to date. Much is still to be learned of the Labrador mammals, and the present list is doubtless incomplete. Only one of the species given by Mr. Low is dropped, — the musk ox, — Mr. Low himself saying that it is extremely doubtful if it ever occurred in Labrador. I follow Mr. Low in including several other species that occur in southwestern Labrador only, as the moose, the fisher, and the skunk. Doubtless there are many more of this category. No material is available from southern Labrador, and the mammals of that region are little known. It is more than probable that most of the usual forms of the upper Canadian and lower Hudsonian faunas occur there. At Lake Edward, Quebec, I took such species as *Microtus pennsylvanicus fontigenus*, *M. chrotorrhinus*, *Evotomys gapperi*, *Synaptomys fatuus*, *Peromyscus canadensis abietorum*, *Sorex hoyi*, *S. albibarbis*, and *Blarina brevicauda*. Without doubt the ranges of many if not all of these extend along the shore of the Gulf of St. Lawrence, and thus enter Labrador.

Two mammals are added by me as new forms — the Labrador black bear and the marten of North Labrador.

I am able to add but little to Mr. Low's account of most of the mammals, and have confined myself chiefly to recording the localities at which specimens have been taken, or the different species have been observed, quoting freely from Mr. Low.

LITERATURE.

In addition to Mr. Low's list, the following are the more important references to Labrador mammalia that have lately appeared:

1867. A. S. PACKARD. List of the Vertebrates Observed at Okak, Labrador, by Rev. Samuel Weiz, with annotations by A. S. Packard, Jr., M.D. *Proc. Boston Soc. Nat. Hist.* pp. 264–277. March, 1867.

1883. W. A. STEARNS. Notes on the Natural History of Labrador. *Proc. U. S. Nat. Mus.* Vol. vi, pp. 111–137. Aug. 1, 1883.

1889. C. HART MERRIAM. A New Genus and Four New Species of Arvicolinæ. *North Am. Fauna.* No. 2, pp. 27–35. 1889. (Contains descriptions of *Phenacomys celatus*, *P. ungava*, and *P. latimanus*.)

1891. A. S. PACKARD. The Labrador Coast. N. D. C. Hodges, Pub., New York. (In both of Packard's and in Stearns's works lists of the Labrador mammalia are given. These lists are much alike, are very imperfect, and were evidently taken one from the other. They call for no special comment, except that the raccoon (*Procyon lotor*) is given from Square Island. This is probably an error, as the locality is far beyond the known northern limit of range of the raccoon.)

1894. F. W. TRUE. Mictomys innuitus, New Genus and Species from Fort Chimo, Labrador. *Proc. U. S. Nat. Mus. Wash.* Vol. xvii, No. 999. Advance sheet. April 26, 1894.

1896. SAM'L N. RHOADS. The Polar Hares of Eastern North America, with Descriptions of New Forms. *Am. Nat.* pp. 251–256. March, 1896. (Containing description of *Lepus arcticus bangsii*.)

1896. SAM'L N. RHOADS. Synopsis of the Polar Hares of North America. *Proc. Acad. Nat. Sci.* pp. 351–376. Philadelphia, 1896. (With fuller accounts of the different forms, plates of skulls, etc.)

1896. O. BANGS. Preliminary Description of a New Vole from Labrador. *Am. Nat.* Vol. xxx, p. 1051. Dec. 5, 1896.

1897. VERNON BAILEY. Revision of the American Voles of the Genus *Evotomys*. *Proc. Biol. Soc. Wash.* pp. 113–138. May 13, 1897. (Containing descriptions of *Evotomys ungava*, by Bailey, and *E. proteus*, by Bangs.)

1897. O. BANGS. On a Small Collection of Mammals from Hamilton Inlet, Labrador. *Proc. Biol. Soc. Wash.* pp. 235–240. Sept. 17, 1897.

1898. VERNON BAILEY. Preliminary Description of *Microtus pennsylvanicus labradorius*. *Proc. Biol. Soc. Wash.* Vol. xii, p. 88. April 30, 1898.

MATERIAL.

The first important collection of mammals from Labrador was the one made in 1882 by L. M. Turner, while stationed at Fort Chimo, Ungava. Several new forms have been described from this material, which is in the National Museum at Washington. Unfortunately, it is of rather poor quality; the small mammals are preserved in alcohol, and the larger ones are mostly flat skins, usually without skulls, and often very imperfect.[1]

In the summer of 1895 Mr. C. H. Goldthwaite made a collection of mammals for the Bangs collection at Rigoulette, on Hamilton Inlet, upon which I have already reported.

In the summer of 1897 Mr. J. D. Sornborger, while in northern Labrador, obtained a good many skulls of the larger mammals, principally by purchasing them from the Eskimo. These are also in the Bangs collection.

Besides these lots, about all the available material from Labrador consists of a few specimens in the collection of the Geological Survey of Canada, which Prof. John Macoun has kindly sent me for examination. Among them is one specimen of *Zapus insignis*, and one of *Peromyscus maniculatus*.

PHYSICAL GEOGRAPHY.

In view of Mr. Low's careful descriptions of every part of the Labrador Peninsula it is useless to say more than a word in a very general way about the features of the region. The country consists, roughly speaking, of three general kinds: the barrens, the semi-barrens, and the forest — mostly of spruce and fir. Descriptions of any particular region can be found in Mr. Low's report.

[1] Through the kindness of Mr. F. W. True and Mr. Gerrit S. Miller, Jr., I have had an opportunity of examining Turner's material.

The distribution of the different species is still very imperfectly known, but of course many species find their northern limit where the forest ends, while others are confined to the barrens and semi-barrens. There is quite a difference between the smaller mammals from the region about Hamilton Inlet and those from Fort Chimo, but just where the line is to be drawn that divides the two sets of forms I am at present unable to say. Many of the forms in these two regions appear, however, to be specifically distinct.

1. MONODON MONOCERAS Linn. Narwhal.
   Monodon monoceras Linn. Ed. x, p. 75. 1758.

   Common all along the Labrador coasts.

2. DELPHINAPTERUS LEUCAS (Pallas). White porpoise.
   Delphinus leucas Pallas. "*It.* iii, p. 84, t. iv."

   Common everywhere along the Labrador coasts.[1]

3. LEPUS AMERICANUS AMERICANUS Erxl. American varying hare.
   Lepus americanus Erxl. *Syst. Anim.* p. 330. 1777.
   Type Locality. South side of Hudson Strait.

   Common throughout the wooded region and extending into the edge of the barrens. Goldthwaite took fourteen specimens at Hamilton Inlet.

4. LEPUS ARCTICUS BANGSII Rhoads. Newfoundland Arctic hare.
   Lepus arcticus bangsii Rhoads. *Am. Nat.* p. 253. March, 1896.
   Type Locality. Codroy, Newfoundland.

   The dark-colored, more southern form of the Arctic hare is of general distribution in the barrens and semi-barrens of Labrador, occasionally reaching as far south as Hamilton Inlet. Turner took specimens at Fort Chimo and Solomon Island.

5. ERETHIZON DORSATUS (Linn). Canada porcupine.
   Hystrix dorsata Linn. *Syst. Nat.* Ed. x, vol. i, p. 57. 1758.

[1] Several other cetaceans are given by Packard in his list of the mammals of the Labrador coast. Mr. Low does not include these, although he often quotes from Packard and from Stearns. I therefore follow Mr. Low in omitting them.

Common from the St. Lawrence north to the semi-barrens.

Turner took a specimen at Fort Chimo. This skin (no skull can be found) is in the National Museum, where I examined it. It is nearly uniform black, with but very few lighter rings on the long hairs and quills. The densely woolly hair is very long, entirely concealing the quills. The tail is short.

I feel sure this porcupine represents a good geographical race. Skulls of the porcupine from as far north as Nova Scotia begin to show differences from those of New Hampshire and Maine, and undoubtedly these characters will prove to be carried farther still in Labrador specimens.

6. ZAPUS HUDSONIUS HUDSONIUS (Zimmermann). Jumping mouse.

Dipus hudsonius Zimmermann. *Geog. Gesch.* Vol. ii, p. 358. 1780.

Apparently not common. Goldthwaite took three at Rigoulette, Hamilton Inlet, all in the spruce woods.

7. ZAPUS INSIGNIS Miller. Woodland jumping mouse.

Zapus insignis Miller. *Am. Nat.* Vol. xxv, p. 742. 1891.

Low took one specimen at Hamilton River. This is mounted and in the Geological Survey of Canada collection. I have examined it and do not feel at all sure that more specimens would not show the Labrador form to be a good sub-species.

8. FIBER ZIBETHICUS ZIBETHICUS (Linn). Muskrat.

Castor zibethicus Linn. *Syst. Nat.* Ed. xii, vol. i, p. 79. 1766.

Low says of the muskrat that it is common in the southern wooded region, but rare along the Upper Hamilton River.

Goldthwaite took one at Rigoulette. Turner took it at Fort Chimo.

9. DICROSTONYX HUDSONIUS (Pallas). Hudson Bay lemming.

Mus hudsonius Pallas. Glir. p. 203. 1778.

Found throughout the barrens and on the treeless hills, south, at least, to Hamilton Inlet.

Low took it at Lake Michikamaw. Goldthwaite trapped four at Rigoulette. I have also examined a mounted specimen from Port Burwell, collected in 1884 by Dr. Bell, in the Geological Survey of Canada collection.

10. SYNAPTOMYS (MICTOMYS) INNUITUS (True). True's lemming.

Mictomys innuitus True. *Proc. Nat. Mus.* Vol. xvii, No. 999. Advance sheet. April 26, 1894.

Type Locality. Fort Chimo, Labrador.

Known at present only by the type and one specimen, not typical, taken at Rigoulette by Goldthwaite.

11. MICROTUS ENIXUS Bangs. Larger Labrador vole.

Microtus enixus Bangs. *Am. Nat.* Vol. xxx, p. 105. 1896.

Type Locality. Rigoulette, Hamilton Inlet, Labrador.

Probably common throughout all the wooded regions, its range extending north to the semi-barrens and meeting that of the next form — *M. pennsylvanicus labradorius*.

Goldthwaite took a large series at the type locality. I have examined three specimens in the collection of the Geological Survey of Canada, from "50 miles north of Fort George." Turner took quite a number at Fort Chimo.

12. MICROTUS PENNSYLVANICUS LABRADORIUS Bailey. Small Labrador vole.

Microtus pennsylvanicus labradorius Bailey. *Proc. Biol. Soc. Wash.* p. 88. April 30, 1898.

Type Locality. Fort Chimo, Ungava, Labrador.

This little vole probably occurs only in the barrens and semi-barrens. It can be told from *M. enixus* by its smaller size, shorter, more hairy tail, by its smaller, flatter skull, with shorter rostrum and nasals, and smaller, shorter incisive foramina, differently shaped zygoma, and larger auditory bullæ. There are probably color differences also, but I have seen alcoholic specimens only. Turner took many specimens at Fort Chimo.

13. EVOTOMYS UNGAVA Bailey. Ungava red-backed mouse.

Evotomys ungava Bailey. *Proc. Biol. Soc. Wash.* p. 130. 1897.

Type Locality. Fort Chimo, Labrador.

Probably restricted to the barrens and semi-barrens. Turner reported the species to be abundant at Fort Chimo, but apparently did not send many specimens to Washington.

The differences between this and the next species appear to be as great as between any two members of the genus *Evotomys*.

14. EVOTOMYS PROTEUS Bangs. Hamilton Inlet red-backed mouse.

Evotomys proteus Bangs. *Proc. Biol. Soc. Wash.* p. 137. 1897.

Type Locality. Rigoulette, Hamilton Inlet, Labrador.

Very abundant at Hamilton Inlet, and probably throughout the wooded regions. Goldthwaite took a large series at Rigoulette.

15. PHENACOMYS LATIMANUS Merriam. Small yellow-faced phenacomys.

Phenacomys latimanus Merriam. *North Am. Fauna.* No. 2, p. 34. 1889.

Type Locality. Fort Chimo, Ungava, Labrador.

Probably of general distribution in the drier semi-barrens. Known from Labrador only by the specimens sent to Washington by Turner.

16. PHENACOMYS UNGAVA Merriam. Large yellow-faced Phenacomys.

Phenacomys ungava Merriam. *North Am. Fauna.* No. 2, p. 30. 1889. (Fort Chimo, Lab.)

Phenacomys celatus Merriam. *North Am. Fauna.* No. 2, p. 33. 1889. (Godbout, Quebec.)

Type Locality. Fort Chimo, Ungava, Labrador.

Taken at Fort Chimo by Turner, at Rigoulette by Goldthwaite, and at Groswater Bay (= Hamilton Inlet) by Dr. Coues (2 skulls).

Goldthwaite's series from Rigoulette, sixteen in number, were all caught in one place in the spruce woods. The adults are much larger than the type of the species from Fort Chimo, and may represent a larger, more southern, sub-species.

17. PEROMYSCUS MANICULATUS (Wagner). Labrador deer mouse.

Hesperomys maniculatus Wagner. *Weigmann's Archiv.* Vol. xi, 1845.

Type Locality. "The Moravian settlements in Labrador."

Unfortunately, this mouse is at present little known; neither Turner nor Goldthwaite took specimens. Low reports it as being common at Northwest River, Hudson's Bay Port. I have seen and examined but one example — a fine adult female from Great Whale River, in the collection of the Geological Survey of Canada. This specimen I have compared with the type of *Peromyscus texensis arcticus* Mearns, and the two appear to be identical.

The Great Whale River specimen of *P. maniculatus* (measured by me from a well-made skin) has the following dimensions: total length, 166; tail vertebræ, 74; pencil, 5; hind foot, 19.5. The type of *P. texensis arcticus* (measured by me from well-made skin): total length, 168; tail vertebræ, 73; pencil, 5; hind foot, 20. In color they agree exactly. The skull of the Great Whale River specimen is peculiar. It is very large, with an extremely broad, flat brain case and heavy rostrum. The molar teeth are also large. The skull of the type of *P. texensis arcticus* is in the skin, and at present I am unable to examine it. The shorter tail and different skull of *P. maniculatus* distinguish it from any of the members of the *canadensis* group.

For the present, until more material from Labrador is available, the question of the relationship of *P. texensis arcticus* and *P. maniculatus* cannot be settled, though it is probable that they are the same. One point is perfectly clear — that *P. maniculatus* is a splendid, distinct species.

18. CASTOR CANADENSIS Kuhl. Canadian beaver.

Castor canadensis Kuhl. *Beiträge zur Zoologie.* p. 64. 1820.

Low says the beaver is common in the wooded regions, and extends into the semi-barrens where food is found. I have seen no Labrador specimens.

19. ARCTOMYS MONAX MELANOPUS (Kuhl). Hudsonian woodchuck.

Arctomys melanopus Kuhl. *Beiträge.* p. 64. 1820.

Common in the country between Lake St. John and the East Main River, Low. I have seen no Labrador specimens; without doubt the form found there is *melanopus*.

20. SCIURUS HUDSONICUS HUDSONICUS Erxl. Northern pine squirrel; red squirrel.

Sciurus vulgaris ε. *hudsonicus* Erxl. *Mammalia.* p. 416. 1777.

Type Locality. Hudson Strait.

Common in the wooded regions and extending into the semi-barrens. Goldthwaite took specimens at Rigoulette. Turner took specimens at Fort Chimo and at Forks, Northwest River.

21. SCIUROPTERUS SABRINUS (Shaw). Severn River flying squirrel.

Sciurus sabrinus Shaw. *Gen. Zoöl.* Vol. i, p. 15 F. 1801.

Common in the valley of the Lower Hamilton River and about the head of Hamilton Inlet, Low. I have not seen any specimens from Labrador. Turner sent one to Washington; although catalogued, it cannot now be found.

22. SOREX PERSONATUS I. Geoff. St. Hilaire. Common shrew.

Sorex personatus I. Geoff. St. Hilaire. *Mém. Mus. d'Hist. Nat. Paris.* Vol. xv, p. 122. 1827.

Taken at Sandwich Bay by Low, at Rigoulette by Goldthwaite, and at Fort Chimo by Turner.

23. CONDYLURA CRISTATA (Linn). Star-nosed mole.

SOREX CRISTATUS Linn. *Syst. Nat.* Ed. x, vol. i, p. 53. 1758.

Goldthwaite saw and fully identified a star-nosed mole that the dogs had caught at Rigoulette. As he assures me there is not the slightest chance of a mistake in his identification, the species must be included.

24. MYOTIS LUCIFUGUS (Le Conte). Little brown bat.

Vespertilio lucifugus Le Conte. *Mc. Murtries Cuvier.* Appendix, p. 431. 1831.

Low supposed the bats seen by him on Hamilton River and at Lake Mistassini to belong to this species. I took this bat

at Lake Edward, Quebec, and Miller (*North Am. Fauna*, No. 13, p. 63) records it from Godbout and Ottawa, Quebec, and from James Bay, Ontario. It is also found in Newfoundland.

25. MYOTIS SUBULATUS (Say). Say's bat.

Vespertilio subulatus Say. *Long's Exped. to Rocky Mts.* Vol. ii, p. 65, footnote. 1823.

Reported by Stearns from Natashquan. Miller (*North Am. Fauna*, No. 13, p. 76) records specimens from Mt. Forest and North Bay, Ontario, and Godbout and Ottawa, Quebec.

26. ALCE AMERICANUS Jardine. Moose.

Alces americanus Jardine. *Nat. Library*. Vol. iii, p. 125. 1835.

Low is in doubt whether or not the moose enters the southwestern limits of Labrador. It is occasionally killed in the region about Lake Edward, Quebec.

27. RANGIFER CARIBOU (Gml.). Woodland caribou.

Cervus tarandus γ. caribou Gmelin. *Syst. Nat.* Vol. i, p. 177. 1789.

Reported by Low to now be very rare, — almost exterminated, — though formerly abundant throughout the wooded regions. Low also says that the destruction of the woodland caribou has resulted in the dying off, from actual starvation, of a large proportion of the interior Indians, which, in its turn, has caused a great increase in the numbers of the fur-bearing animals.

28. RANGIFER ARCTICUS (Richardson). Barren ground caribou.

Cervus tarandus var. a. *arctica* Richardson. *F. B. A.* Vol. i, p. 241. 1829.

According to Low, the barren ground caribou still ranges in immense herds over the barrens and semi-barrens, south to the Mealy Mountains, between Hamilton Inlet and Sandwich Bay.

29. ROSMARUS ROSMARUS (Linn). Atlantic walrus.

Trichechus rosmarus Linn. *Syst. Nat.* Ed. xii, vol. i, p. 49. 1766.

Now restricted to northern Labrador, reaching south only to about Nachvak. Formerly abundant along the whole Labrador coast. A fine pair, ♂ and ♀, skulls in Bangs's collection, obtained by Sornborger from the Eskimo at Okak.

30. PHOCA VITULINA Linn. Harbor seal.

Phoca vitulina Linn. *Syst. Nat.* Vol. i, p. 38. 1758.

Common along the whole coast and in the lower parts of the rivers. It is also, according to Low, found in many of the fresh-water lakes of the interior, and the Indians assert that these fresh-water seals never leave the lakes. This should be carefully looked into, and it is to be hoped that collectors in Labrador may be able to take some of these fresh-water seals.

One skull in Bangs's collection from Okak, obtained by Sornborger from the Eskimo.

31. PHOCA (PUSA) HISPIDA Schreber. Ringed seal.

Phoca hispida Schreber. *Säugt.* Vol. iii, p. 312, Pl. LXXXVI. 1775. (*Vide* Thomas. *Zoölogist*, p. 102. 1898.)

Common along the entire Labrador coast.

32. PHOCA (PAGOPHILUS) GRŒNLANDICA Fabricius. Harp seal.

Phoca grœnlandica Fabricius. *Müller's Zool. Dan. Prod.* Vol. viii. 1776.

Common along the whole Labrador coast.

33. ERIGNATHUS BARBATUS (Fabricius). Bearded seal.

Phoca barbata Fabricius. *Müller's Zool. Dan. Prod.* Vol. viii. 1776.

Low reports this seal to be rare in the St. Lawrence and in southern Labrador, but more common northward — in Hudson Strait, Hudson Bay, and James Bay.

34. HALICHŒRUS GRYPUS (Fabricius). Gray seal.

Phoca grypus Fabricius. *Skriv. af. Naturh.-Selsk.* Vol. i, ii, p. 167, Pl. XIII, Fig. 4. 1791.

Rare along the Labrador coast.

35. CYSTOPHORA CRISTATA (Erxleben). Hooded seal.

Phoca cristata Erxleben. *Syst. Reg. Anim.* p. 590. 1777.

Not common along the Labrador coast.

36. THALARCTOS MARITIMUS (Linn). Polar bear; ice bear.

Ursus maritimus Linn. *Syst. Nat.* Ed. xii, vol. i, p. 70. 1766.

Low says the polar bear ranges south along the Atlantic coast of Labrador occasionally as far as the Strait of Belle Isle, and in Hudson Bay to Charleton Island. The species seldom goes far inland, except to produce its young. Sornborger told me that the polar bear is very common and resident in northern Labrador.

Four skulls in Bangs's collection, all obtained by Sornborger of the Eskimo at Hebron and Okak.

37. URSUS RICHARDSONII Mayne Reid. Barren ground bear.

Ursus richardsonii Mayne Reid. *Bruin: The Great Bear Hunt.* London, 1860. American Ed., pp. 260, 261. 1864.

Although no specimens have ever found their way into collections, there is no longer any doubt that a huge bear is found in the barrens of Labrador. Low says that the Mascaupee Indians have many tales of its size and ferocity. I can see no reasonable doubt that this bear is true *U. richardsonii.*

38. URSUS (EUARCTOS) AMERICANUS SORNBORGERI sub. sp. nov. Labrador black bear.

Type. From Okak, Labrador. Skull No. 7411, young adult (probably ♀), collection of E. A. and O. Bangs, obtained in the summer of 1897 by J. D. Sornborger from the Eskimo.

Subspecific Characters. The skull differs from that of true *U. americanus* from Maine, Nova Scotia, etc., in being smaller; very much shorter and broader; brain case short and broad; zygoma widely spread; frontal region low, broad, and flat, with great width across post-orbital processes; nasals short; palate much shorter and broader; molar teeth large.

External characters unknown.

Measurements. The type, young adult (probably ♀). Basilar length of Heusel, 205; occipito-nasal length, 187.4; zygomatic breadth, 129.6; mastoid breadth, 101.4; breadth between post-orbital processes, 72.6; inter-orbital breadth, 51.2; palatal length, 114.6; post-palatal length, 91; greatest length of single half of mandible, 164.

Remarks. Mr. Sornborger brought back from Labrador three fine skulls of the Labrador black bear: one from Hopedale, No. 7412, middle-aged adult (probably ♂); one from Maine, a two-thirds grown young; and the type of the form from Okak.

These three skulls show the black bear of the Labrador Peninsula to be easily separable from that of the Canadian regions of eastern North America. It is to be regretted that no skins were procured, as the external characters remain unknown.

The Labrador black bear is common throughout Labrador north to the tree limit. One would expect to find specimens from southwestern Labrador more nearly like true *U. americanus*, if not that form itself.

39. GULO LUSCUS (Linn). American wolverine.

Ursus luscus Linn. *Syst. Nat.* Ed. x, vol. i, p. 47. 1758.

Abundant throughout Labrador, especially northward to Hudson Strait.

Two skulls from Okak in Bangs's collection, obtained by Sornborger. Turner sent one specimen to Washington from Fort Chimo.

40. LUTRA HUDSONICA HUDSONICA Lacépède. Hudsonian otter.

Lutra hudsonica "Lacépède. 1803."

Low states the other to be common throughout the wooded region and to range northward into the semi-barrens. One skull in Bangs's collection from Okak, Sornborger. Turner sent one specimen to Washington from "Forks," Ungava. (Although it appears in the catalogue, it cannot now be found.)

41. MEPHITIS MEPHITICA MEPHITICA (Shaw). Skunk.

Viverra mephitica Shaw. *Museum Leverianum.* p. 172. 1792.

Said by Stearns to be found occasionally on the southern coast of Labrador. I found it common at Lake Edward, Quebec, and it is probable that its range does reach Labrador.

42. MUSTELA AMERICANA Turton. Sable; marten.

Mustela americana. Turton's Linnæus. Vol. i, p. 60. 1806.

True *M. americana* probably occurs in southern Labrador, though I have seen no specimens. I took it at Lake Edward, Quebec. The form described below as *M. brumalis* is so different from true *M. americana*, that in the lack of any intermediate specimens I can feel justified only in regarding it as a distinct species. Low's remark, that "the largest and darkest skins are taken along the edge of its northern limits," also inclines me to the belief that two forms are found in Labrador, and that they are specifically distinct.

A complete series of good specimens from points along the whole peninsula would be of the greatest interest, and is one of the things to be hoped for in the future, as marten are common all through the Labrador Peninsula north to the tree limit.

43. MUSTELA BRUMALIS sp. nov. North Labrador marten.

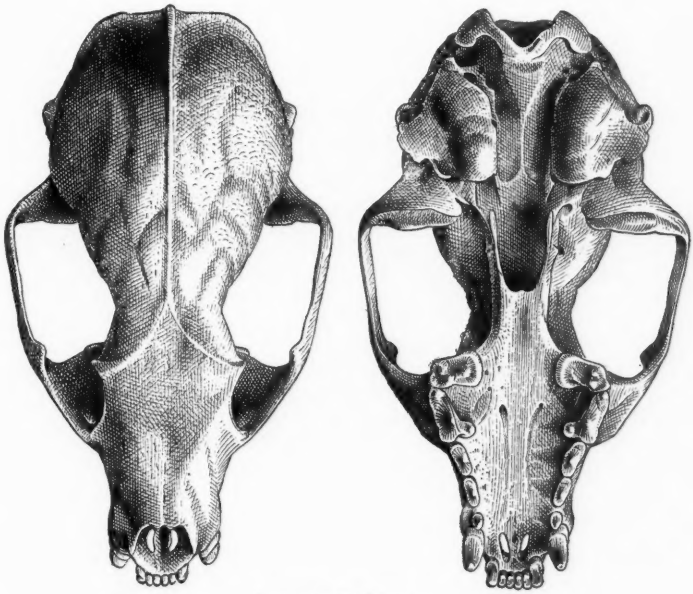
Type. From Okak, Labrador; skull, adult (probably ♂) No. 7417, collection of E. A. and O. Bangs. Obtained by J. D. Sornborger in the summer of 1897 from the Eskimo.

Specific Characters. Skull large, powerful, and heavy; rostrum very short and broad; frontals highly arched; auditory bullæ very large and deep; dentition extremely heavy throughout, the last upper molar in particular being very large; the tooth row a good deal crowded.

External characters unknown.

Measurements. Skull, the type, adult (probably ♂). Basilar length of Heusel, 78.6; zygomatic breadth, 51; mastoid breadth, 38.8; inter-orbital breadth, 19.6; breadth between post-orbital processes, 23.8; width of muzzle across canines, 17.2; greatest length of auditory bulla, 17.2; greatest length of single half of mandible, 58.4; length from front of canine to back of last molar (upper jaw, alveoli), 30.6.

Remarks. Mr. Sornborger brought back from Labrador last summer three skulls of *M. brumalis*, all from Okak. They are unsexed, though all are undoubtedly males. Two are adult and one a young adult, with the nasal sutures plainly visible. When compared with skulls of true *M. americana* from Maine, Quebec, etc., these Labrador skulls show very striking differences; their large size, short, wide rostrums, and enormous



SKULLS OF M. BRUMALIS.

teeth at once distinguishing them. Compared with skulls of *M. caurina* the likeness in these respects is greater, but the highly arched frontals and large, deep auditory bullæ of *M. brumalis* are very different from the flattened frontals and small, short, totally differently shaped auditory bullæ of that species.

It is very much to be regretted that there are no skins of *M. brumalis* for comparison, as from Low's casual remark, quoted above, I feel sure there are external characters by which *M. brumalis* can be told from *M. americana*.

44. MUSTELA PENNANTII Erxl. Pennants's marten, Fisher.

Mustela pennantii Erxl. *Syst. An.* p. 479. 1777.

Pennants's marten, according to Low, rarely enters the southwestern limits of Labrador, not occurring east of Mingan nor north of Mistassini.

45. PUTORIUS (LUTREOLA) VISON VISON (Schreber). Little black mink.

Mustela vison Schraeber. *Säugt.* Vol. iii, p. 463. 1778.

Low says the mink is found only in the southern part of Labrador, seldom occurring north of East Main and Hamilton Rivers. I found it very common at Lake Edward, Quebec, but have never seen a Labrador specimen.

46. PUTORIUS (ARCTOGALE) CICOGNANII CICOGNANII (Bonap.). Small brown weasel.

Mustela cicognanii Bonap. *Fauna, Italica, Mamm.* p. 4. 1838.

Reported by Low to be common everywhere south of tree limit.

Goldthwaite took two specimens, ♂ and ♀, at Rigoulette. Turner took one at "Forks," Ungava.

One would expect to find *Putorius cicognanii richardsonii* occurring in the semi-barrens of northern Labrador, but the three specimens referred to above are all true *cicognanii.*

47. VULPES LAGOPUS (Linn). Arctic fox.

Canis lagopus Linn. *Syst. Nat.* Ed. xii, vol. i, p. 59. 1766.

The Arctic fox is abundant in the barren grounds and extends south to about Lake Michikamaw and to Nichicum. Along both coasts it pushes rather farther south; on the Atlantic to Hamilton Inlet, and rarely even to the Strait of Belle Isle; on the coast of James Bay to its southern part.

Two skulls in Bangs's collection from Hebron, obtained by Sornborger.

48. VULPES PENNSYLVANICA subsp.? Red fox.

Common throughout the whole of Labrador from the St. Lawrence to Hudson Strait.

Six skulls in Bangs's collection, obtained by Sornborger at Hopedale and Okak. One wretched skin in National Museum, Washington, collected at Kokwak River, Ungava, by Turner.

The Labrador red fox is not true *V. pennsylvanica*, but until I have seen material enabling me to study its external characters, I am unwilling to refer it definitely to any form.

49. CANIS ALBUS Joseph Sabine. Arctic wolf.

Canis lupus — albus Joseph Sabine. *Franklin's Narrative.* Appendix, p. 655. 1823.

Occasionally taken in northern barren grounds, Low.

50. CANIS OCCIDENTALIS Richardson.[1] Timber wolf.

Canis lupus, occidentalis Richardson. *F. B. A. Mamm.* p. 60. 1829.

According to Low, the timber wolf is now very rare in the southern wooded region, owing to the extermination of the woodland caribou. It is still common in the barrens and semi-barrens of the north.

One skull in Bangs's collection from Hopedale, collected by Sornborger.[2]

51. LYNX CANADENSIS (Geoff.). Canada lynx.

Felis canadensis. "Geoff. *Var. Mus.*"

Common within the wooded area from the Atlantic coast to Hudson Bay, Low.

[1] I use Richardson's name, *Canis occidentalis*, for the timber wolf of eastern North America, not that I feel sure it is the name that will eventually stand for that animal, but in the confused state of the nomenclature of our large wolves I see no other course to follow at present. *Canis griseus* Sabine cannot be used, as it is preoccupied by the *Canis griseus* Boddaert, 1784, one of the synonyms of the gray fox, *Urocyon cinereo-argentatus*.

[2] The Eskimo dog, *Canis familiaris*, var. *borealis* Desmarest, is included by Low in his list. Although in a semi-wild state for a part of the year, the Eskimo dog does not seem to me entitled to a place in the list of the mammals of Labrador.

	PRESENT LIST.	A. P. LOW'S LIST. [In Annual Report, *Geological Survey of Canada*, vol. viii, 1895.]
1.	*Monodon monoceras* Linn.	*Monodon monoceras* Linn.
2.	*Delphinapterus leucas* (Pallas).	*Delphinapterus catodon* Linn.
3.	*Lepus americanus* Erxl.	*Lepus americanus* Erxl.
4.	*Lepus arcticus bangsii* Rhoads.	*Lepus timidus* Linn, var. *arcticus* Leach.
5.	*Erethizon dorsatus* (Linn).	*Erethizon dorsatus* Linn.
6.	*Zapus hudsonius* (Zimmermann).	*Zapus hudsonius* Zimmermann.
7.	*Zapus insignis* Miller.	
8.	*Fiber zibethicus* (Linn).	*Fiber zibethicus* Linn.
9.	*Dicrostonyx hudsonius* (Pallas).	*Cuniculus torquatus* Pallas.
10.	*Synaptomys innuitus* (True).	
11.	*Microtus enixus* Bangs.	*Arvicola riparius* Ord.
12.	*Microtus pennsylvanicus labradorius* Bailey.	
13.	*Evotomys ungava* Bailey.	
14.	*Evotomys proteus* Bangs.	
15.	*Phenacomys latimanus* Merriam.	
16.	*Phenacomys ungava* Merriam.	
17.	*Peromyscus maniculatus* (Wagner).	*Hesperomys leucopus* Rafinesque.
18.	*Castor canadensis* Kuhl.	*Castor fiber* Linn.
19.	*Arctomys monax melanopus* (Kuhl).	*Arctomys monax* Linn.
20.	*Sciurus hudsonicus* Erxl.	*Sciurus hudsonius* Pallas.
21.	*Sciuropterus sabrinus* (Shaw).	*Sciuropterus volucella* Pallas, var. *hudsonius* Gml.
22.	*Sorex personatus* I. Geoff. St. Hilaire.	*Sorex personatus* Geoffrey St. Hilaire.
23.	*Condylura cristata* (Linn).	
24.	*Myotis lucifugus* (Le Conte).	*Vespertilio lucifugus* Le Conte.
25.	*Myotis subulatus* (Say).	*Vespertilio subulatus* Say.

		Ovibus moschatus Zimmermann.
26.	*Alce americanus* Jardine.	*Alce americanus* Jardine.
27.	*Rangifer caribou* (Gml.).	*Rangifer caribou* Linn.
28.	*Rangifer arcticus* (Richardson).	*Rangifer grœnlandicus* Linn.
29.	*Rosmarus rosmarus* (Linn).	*Obodœnus rosmarius* Malmgren.
30.	*Phoca vitulina* Linn.	*Phoca vitulina* Linn.
31.	*Phoca hispida* Schreber.	*Phoca fœtida* Fabricius.
32.	*Phoca grœnlandica* Fabricius.	*Phoca grœnlandica* Fabricius.
33.	*Erignathus barbatus* (Fabricius).	*Erignathus barbatus* Fabricius.
34.	*Halichœrus grypus* (Fabricius).	*Halichœrus grypus* Fabricius.
35.	*Cystophora cristata* (Erxl.).	*Cystophora cristata* Erxl.
36.	*Thalarctos maritimus* (Linn).	*Thalassarctos maritimus* Linn.
37.	*Ursus richardsonii* Mayne Reid.	*Ursus arctos* Richardson.
38.	*Ursus americanus sornborgeri* Bangs.	*Ursus americanus* Pallas.
39.	*Gulo luscus* (Linn).	*Gulo luscus* Linn.
40.	*Lutra hudsonica* Lacépède.	*Lutra canadensis* Turton.
41.	*Mephitis mephitica* (Shaw).	*Mephitis mephitica* Shaw.
42.	*Mustela americana* Turton.	*Mustela americana* Turton.
43.	*Mustela brumalis* Bangs.	
44.	*Mustela pennantii* Erxl.	*Mustela pennantii* Erxl.
45.	*Putorius vison* (Schreber).	*Putorius vison* Brisson.
46.	*Putorius cicognanii* (Bonap.).	*Putorius vulgaris* Linn. *Putorius ermineus* Linn.
47.	*Vulpes lagopus* (Linn).	*Vulpes lagopus* Linn.
48.	*Vulpes pennsylvanica* (subsp.?) Boddaert.	*Vulpes vulgaris* Flemming.
49.	*Canis albus* Joseph Sabine.	*Canis lupus*, var. *albus*.
50.	*Canis occidentalis* Richardson.	*Canis lupus* Linn. *Canis familiaris* Say.
51.	*Lynx canadensis* (Geoff.).	*Lynx canadensis* Desmarest.

VARIATION IN THE NUMBER OF RAY-FLOWERS IN THE WHITE DAISY.

F. C. LUCAS.

[THE following fragmentary observation of Mr. Lucas is of importance because of its relation to the extended series of enumerations of the ray-flowers of the white daisy (*Chrysanthemum lucanthemum*) of Europe, which has lately been made by Prof. F. Ludwig, of Greiz, and published in the *Botanisches Centralblatt*. Ludwig finds that the commonest number, the mode, is 21. There are, however, several secondary maxima, which with the principal mode constitute the series 8, 13, 21, 34 — the series of Fibonacci. The counts of Mr. Lucas are interesting in that, first, the mode in the number of ray-flowers is different for two localities, and, secondly, while one of these modes (21) falls in the Fibonacci series, the other (22) has no relation to it. The secondary maximum, which in both curves is found at 29, is likewise not in accord with Ludwig's law. These simply made observations, then, raise the questions whether the mode of a varying organ may not vary decidedly in different localities, and whether Ludwig's law will, even with an indefinitely large number of counts, hold for the white daisy as we find it in America. ED.]

During the latter part of my vacation in the summer of 1897, I was in Nova Scotia, and, abundant material being at hand, I thought I would see if I could verify the law of variation in the ray-flowers of the common ox-eye daisy. I managed in the short time at my disposal to count about 500 specimens from the regions of Yarmouth and Grand Pic. I thought to count enough more when I returned to the States to bring up my total to one thousand. I was much surprised to find, however, for reasons which will appear later, that the flowers of the two regions could not be included in one lot. The specimens counted in the States came from Milton and Cambridge, Mass., and were 324 in number.

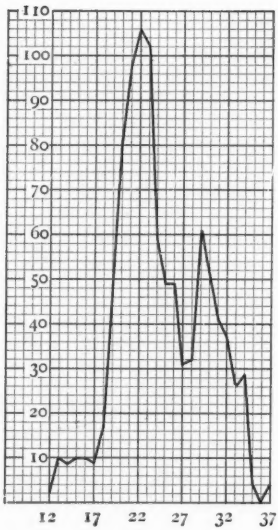

110
100
90
80
70
60
50
40
30
20
10
12
17
22
27
32
37

FIG. 1.

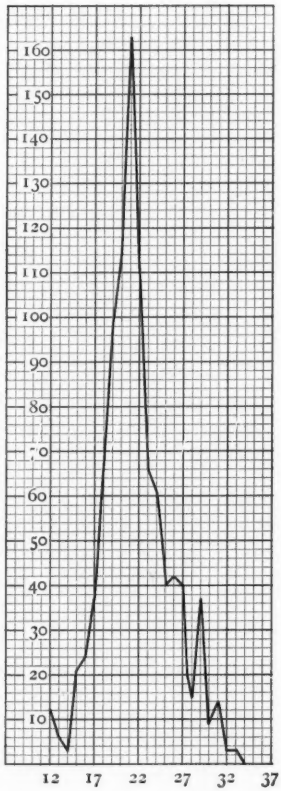

160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
12
17
22
27
32
37

FIG. 2.

No. of Ray Classes.	Nova Scotia. Fig. 1.		Massachusetts. Fig. 2.	
	No. of Indiv.	per 1000.	No. of Indiv.	per 1000.
12	1	2	4	12
13	6	10	2	6
14	5	9	1	3
15	6	10	7	21
16	6	10	8	24
17	5	9	12	37
18	9	17	22	66
19	21	41	32	99
20	41	81	37	114
21	50	98	53	163
22	64	106	36	111
23	52	102	22	66
24	30	59	20	61
25	25	49	13	40
26	25	49	14	43
27	16	31	13	40
28	17	33	5	15
29	31	61	12	37
30	26	51	3	9
31	21	41	5	15
32	19	37	1	3
33	13	26	1	3
34	15	29	—	—
35	2	4	—	—
36	—	—	—	—
37	2	4	—	—
	508		324	

THE DEVELOPMENT OF MANTIS.

T. D. A. COCKERELL.

Dr. D. Sharp, in his admirable work on "Insects" in the *Cambridge Natural History*, vol. v, gives (p. 247) some extraordinary particulars about the development of Mantis, with a figure taken mainly from Dr. Pagenstecher. I have just been observing the facts in the case of a mantis found here, and they do not, in all particulars, agree with Dr. Sharp's account, so that it seems desirable to draw attention to the matter. The eggs removed from the oötheca are elongated and similar to those of Acridiidæ in general appearance; the egg covering is quite strong but brittle. On removing the young from the oötheca, just before the time of hatching, they are found to be already attached by threads, as has been described by others.

Fig. 1.

Fig. 2.

Fig. 1 represents one of these young. It is well colored, and all its parts are formed; but, as will be seen from the figure, the head has a peculiar appearance, and the legs are all close together. The general color is pale greenish-yellow, but there are conspicuous rosy dorsal markings; the internal fluids are bright green. The eyes are at first sage green, but soon after the emergence of the insect they become blackish. Fig. 2 shows the insect after emergence, when it is hanging by its thread. The thorax begins to elongate, with the natural result of forming a hump and bending the head forward. In this way is developed the little mantis, which is much longer than the emerging form, almost wholly by the elongation of the thorax. In my species the insects certainly do not hang for "some days," since examples which hatched out yesterday, at the earliest,

were running about fully formed this morning. I have been quite unable to see any legs such as Pagenstecher describes for the newly hatched young; from the time previous to hatching the normal legs are well formed and there are no others. Nor can I satisfy myself that there is any real ecdysis between the pupa-like form and the active young; at least, all that is shed is apparently a thin egg-membrane, chitinized, however, over the head, forming a sort of cap to protect the bulging anterior end in emergence. Since this structure is developed in the egg, and shed immediately after emergence, should it not be regarded as an oval envelope?

In view of the above observations, it certainly seems desirable that those recorded for *Mantis religiosa* should be confirmed, as I can hardly believe them to be wholly correct. The species observed by me is a Stagmomantis, either *S. carolina* or *S. limbata;* I am not sure which, as both occur in the Mesilla Valley.

MESILLA PARK, NEW MEXICO, U. S. A.,
May 6, 1897.

EDITORIALS.

The Fiftieth Anniversary of the American Association for the Advancement of Science, to be celebrated in Boston in August next, is an occasion when every naturalist in the country will wish to join with his coworkers in other departments of science in celebrating fifty years of scientific activity in America.

Glancing at the history of the association, we find that in 1840 a number of geologists and naturalists of the several state geological and natural history surveys met in Philadelphia for the purpose of discussing the results of their investigations. At this gathering it was determined to organize an Association of Geologists and Naturalists. Edward Hitchcock, State Geologist of Massachusetts and President of Amherst College, was elected president of the association. Annual meetings were held until 1847, when at the meeting held in Boston it was decided to enlarge the scope of the organization so as to include all branches of science, and to reorganize under the name of American Association for the Advancement of Science. Boston, therefore, has the honor of being the birthplace of the present association, although the first regular meeting was held in Philadelphia in 1848. At this meeting Prof. William B. Rogers presided as chairman of the old association, and introduced Prof. W. C. Redfield as the first president of the new association.

The year 1898 marks the fiftieth anniversary of the organization of this association, and the city of Boston was naturally chosen for the celebration of this anniversary. It is the intention of the officers of the several sections to bring out in their programmes, as far as possible, summaries of the progress and achievements of science during the past half century. The Preliminary Programme of Section A, which is already printed, carries out this idea by including "Reports on Recent Progress (accompanied with statements of the 'standing problems'), prepared at the special invitation of the officers and committee, 'with a view to obtaining at this anniversary meeting such a survey of the field as may lead to a possible coöperation of effort.'"

The subject of the address of Prof. Wolcott Gibbs as retiring president is: "Some points in theoretical chemistry."

The vice-presidential addresses will be as follows: Vice-President Barnard before Section A, "Development of astronomical photog-

raphy"; Vice-President Whitman before Section B, "On the perception of light and color"; Vice-President Smith before Section C (to be announced later); Vice-President Cooley before Section D (to be announced later); Vice-President Fairchild before Section E, "Glacial geology in America"; Vice-President Packard before Section F, "A half century of evolution, with special reference to the effects of geological changes on animal life"; Vice-President Farlow before Section G, "The conception of species as effected by recent investigations on fungi"; Vice-President Cattell before Section H, "The advance of psychology"; Vice-President Blue before Section I, "The historic method in economics."

The first step toward extending an invitation to the association to hold its Jubilee Meeting in the city of its birth was taken by the Boston Society of Natural History. The suggestion of this society secured the immediate and hearty coöperation of His Excellency Governor Wolcott and of His Honor Mayor Quincy, and was followed by invitations from the various scientific and educational institutions of Boston and vicinity.

The officers of the Massachusetts Institute of Technology and of the Boston Society of Natural History have generously placed their halls and rooms at the disposal of the association, and thus accommodations will be furnished for all sections and for general sessions in three closely adjoining buildings.

The Local Committee, of which the governor of the Commonwealth is the honorary president, and thirty-one presidents of colleges or scientific institutions are the honorary vice-presidents, includes over three hundred other prominent citizens of Boston and vicinity. This committee has been organized into special committees for the furtherance of the arrangements for the meetings, which are to be carried out in a generous and most cordial manner.

The programme for the week as prepared by the permanent secretary, with the coöperation of the Local Committee, is substantially as follows:

Saturday, August 20. Meeting of the Council.

Monday, August 22. General Session in Huntington Hall at 10 A.M. President Gibbs will call the meeting to order and introduce the president-elect, Prof. F. W. Putnam. Addresses of welcome by the governor, the mayor, and the president of the Institute of Technology. Reply of President Putnam. General business and adjournment of the session for the organization of the sections. In the afternoon the nine vice-presidents will deliver their addresses

before their respective sections. These have been grouped under the hours of 2.30, 3.30, and 4.30, thus making it possible for a member to be present at three of the addresses. In the evening Dr. Gibbs will deliver his address as retiring president; this will be followed by a reception given by the Local Committee to the members and guests of the association.

Tuesday, August 23. This day will be given to meetings of the sections, from 10 A.M. At the close of the afternoon session there will be an excursion to Longwood Hotel, Middlesex Fells. In the evening Dr. Thomas Dwight, at the Harvard Medical School, will lecture on "The variation in human bones, with illustrations from the collection of the Medical School."

Wednesday, August 24. On this day the association will be the guest of the Essex Institute in Salem. In the morning members will leave Boston by train or steamboat for the Salem Willows, where a fish chowder will be served. In the afternoon visits will be made to places of historic and scientific interest. Several other excursions are planned for this day. In the evening illustrated lectures on the Boston Park System and Metropolitan Water Supply will be given in Huntington Hall.

Thursday, August 25. This day and evening will be given to meetings of sections. Late in the afternoon there will be an excursion through the parks to the Arnold Arboretum, with refreshments at Franklin Park. At 9 P.M. the Committee will meet to elect the officers and to determine the place of meeting for the next year.

Friday, August 26. By invitation of the President and Fellows, the association will be the guest of Harvard University. At 10.30 and at 11.30 the officers of the scientific departments of Harvard will give brief addresses explanatory of their respective departments. At noon luncheon will be served in Memorial Hall. The afternoon will be given to visiting the several departments of the University and places of historic interest in Cambridge. At 6 P.M. tea in the Hemenway Gymnasium. At 8 P.M. President Eliot will deliver an address in Sanders Theater.

Saturday, August 27. Concluding General Session at 10 A.M., followed by meetings of the sections. In the afternoon there will be excursions to the Riverside Recreation Grounds, Wellesley College, and by boats on the Charles to Norumbega Tower; also to Lexington and Concord. In the evening the sections will hold their closing sessions.

Monday, August 29. Excursions to the White Mountains, Plymouth,

Provincetown, Woods Holl, Newport, Clinton, and Lawrence Experiment Station, and to other minor points.

During the association week and the days immediately preceding, several affiliated societies will meet in Boston, including the American Forestry Association, Geological Society of America, American Chemical Society, Society for the Promotion of Agricultural Science, Association of Economic Entomologists, Botanical Club of the Association, American Mathematical Society, Society for the Promotion of Engineering Education, American Folk-Lore Society, National Geographic Society, and Botanical Society of America.

Many foreign scientists have been invited to take part in the meeting, and it is hoped that the war will not prevent them from being present.

In his circular letter to members of the association, Professor Putnam, the president-elect, who has been permanent secretary for twenty-five years (and to whom all readers of the *Naturalist* are indebted as one of its founders, and the man who for several years carried the principal burden of its publication), makes the following statement: "There are in every community many men and women engaged in scientific work who should be invited to join the association, and there are many more qualified to become members who would find in the meetings of the association the very incentive they need to develop their love of scientific work. I earnestly appeal to every member to make known the objects and character of the association, and to aid in securing such an increase of membership as shall make this fiftieth anniversary a marked event in the history of the association." Certainly there are many readers of the *Naturalist* who will desire to join the association and take part in this most interesting and important meeting.

Card Bibliographies. — The greatest advance made in recent years in the methods of recording the literature of natural history is the card catalogue issued by the Concilium Bibliographicum of Zürich, Switzerland, of which Dr. H. H. Field is the energetic director. The bureau supplies on cards the titles of the current literature of Zoölogy, Physiology, and Anatomy. The price for the cards is so small that every professional man can afford to purchase this invaluable aid to work, and no library consulted by professional men should be without it. The great advantage of the card system does not appear in the first year of its existence, since bibliographies are also to be had in book form; but when the literature of the last three, four, or twenty years is all arranged by subjects, and capable

of any arrangement which the individual student may require, the advantage of cards becomes striking. Dr. Field's work is international in its character and receives financial support from societies both in this country and abroad, as well as from the Swiss government. It is under the special care of a committee of the International Zoölogical Congress. The work is, however, so expensive that Dr. Field finds himself embarrassed from lack of funds in his work. It is quite certain that if more subscribers could be obtained the merits of the undertaking would insure the permanency and gradual extension of the work. All professional zoölogists, physiologists, and anatomists are urged to correspond with Dr. Field, with whom arrangements for cards covering a certain group, such as Coleoptera, or a single system of organs, such as the Nervous System, can be made.

Methods in Systematic Work. — In a recent account of some marine annelids of the Pacific coast Prof. H. P. Johnson has based his descriptions and measurements "almost entirely" upon preserved specimens, and states that "there are positive objections in taking measurements from living worms," and that only in respect to color is there "any advantage in drawing up descriptions from living specimens." To be sure, among the higher annelids, the creeping forms, contractions and distortions in preserved material are not so aggravated as in the swimming and tubicolous forms, and in the latter the difficulty of making drawings or even descriptions from the living animals might be advanced as a positive objection. On the other hand, the poses and flexures of the worms in motion, aside from mere color, are often highly characteristic. The author adds, in extenuation of his method, that "nearly all annelid measurements extant have been made upon alcoholic material." This is true, but why? Because the greater part of the annelid literature, the larger works certainly, have not been based upon collections made by the authors themselves, but upon collections gathered by expeditions or accumulated in museums. On the other hand, the supreme value of such works as those of Schmarda and Claparéde cannot be denied. The ideal condition would be a combination of the two. The naturalist is most fortunate who has living material for study, and willfully to ignore such study is evil. A habit-picture, if merely a description, does require a skilled artist, and is well worth the pains. It is to be deplored that the good old-fashioned methods of nature study, where descriptions were more than mere formulæ, are falling into disuse.

REVIEWS OF RECENT LITERATURE.

ZOÖLOGY.

Jayne's Skeleton of the Cat.[1] — When Mivart's volume on the cat appeared some eighteen years ago, it was a common opinion that the high-water mark of popular scientific monographing had been nearly if not actually touched, and no one supposed that in less than two decades a work of almost twice the size of Mivart's, and dealing with only the skeleton of the cat, would be placed before the public. This imposing volume, by Dr. Horace Jayne, forms the first part of a series on the complete anatomy of the cat. It consists of an introductory chapter, in which are considered the chief divisions of the skeleton, methods of preparing bones, definitions of terms, etc., followed by an exhaustive description of the skeleton of the cat. This is arranged systematically, each group of bones being first briefly outlined and then the separate bones described in detail. After the anatomy of a bone has been minutely portrayed, there usually follows an account of its nomenclature, determination, articulations, muscular attachments, ossification, variations, and finally its relations to the corresponding human bone. Although the subject-matter of the volume is so systematically arranged that any desired reference may be quickly and easily turned to, a well-devised index of some twenty-five pages has been appended.

The importance of terminology in text-books of this character is well recognized, and in these days of revised nomenclatures one turns to a new anatomy for judgments. Dr. Jayne's book will be gratifying chiefly to the conservatives, for, as a rule, he adheres to the older names good and bad alike. In his choice of general descriptive terms he is not always happy. Thus the system of general terms, proposed in the introduction, included the tautological phrase "lateral side," a misdemeanor which is atoned for by its almost complete omission from the body of the text. Nor is the use of special terms always carried out with success. In the description of the cervical vertebræ, the vertebrarterial canal is variously called the arterial canal, the vertebral canal, the foramen for the vertebral artery, and the canal for vessels, and the only clue which the uninitiated are

[1] Jayne, Horace. *Mammalian Anatomy, a Preparation for Human and Comparative Anatomy.* Pt. i. The Skeleton of the Cat. xix + 816 pp. J. B. Lippincott Co., Philadelphia, 1898.

given as to the synonymy of these expressions is on page 55, where the arterial canal is mentioned in the text, and reference is given to a figure (Fig. 28) in which it is called the vertebral canal. This looseness in the use of technical terms, while not so serious for the advanced student, is confusing to the beginner, and, what is much worse, schools him in methods which are flagrant violations of the principles of scientific description.

Not only is there a regrettable looseness in the use of terms, but the definitions of these terms are also often unsatisfactory. Thus, in commenting on the general axes of the vertebrate body, the author tells us (p. 39) that "lines drawn at right angles to the median plane are transverse lines; lines *in or parallel with the median plane are longitudinal lines*, and lines connecting the back and belly are vertical lines," a lapse in geometry rather than in anatomy. Similar inaccuracies of definition occur also in the body of the text; for instance, on page 46, under the title "Characters Common to all Vertebræ," we are told that "each vertebra, whatever its shape, consists of two essential parts, the ventral cylindrical body or centrum, and the dorsal transverse neural arch," and on page 109 we are further informed that the typical caudal vertebra consists "of little more than an elongated body," and that it has "no neural arch." Instances of this kind lead to the conclusion that Dr. Jayne's forte does not lie in making definitions.

Aside from its defects in terminology, the description of the cat's skeleton is remarkably full and accurate. We have read much of it with a specimen in hand, and have found practically nothing worthy of serious criticism. The only real omission that we have noted is that of the relatively insignificant penis bone. In exhaustiveness this description places the osteology of the cat second only to that of the human being. As the chief object of the book is to give a full description of the cat's skeleton and not to advance a system of terminology or modify the existing ones, we must congratulate the author on his success.

The illustrations accompanying the descriptions form one of the most striking features of the volume. To say that they are numerous would be to understate the truth; they are profuse. In the description of the skull the account of each bone is usually accompanied with one or more outlines of the whole skull, on which are shown in heavy lines the limits of the particular bones considered. This method is also used for the bones of the carpus and tarsus, and as in each case the whole hand or foot is reproduced, the extravagance of

the method becomes obvious, for an outline figure covering something over eight square inches is repeated frequently to show the positions of bones often occupying not over an eighth or even a sixteenth of a square inch of surface. The method is certainly better than that of giving only a single general figure on some remote page, but it seems to us less successful and certainly less economical than that of placing the general figures on a folded sheet which, though attached to the book, may be kept in view while any page is being consulted.

Another feature of the illustrations is their size. Those taken from the cat are said to be magnified twice, except where otherwise stated, a rule for which Fig. 524 is an exception. This double magnification is generally satisfactory, for a smaller cut would usually involve the loss of some important details; but the enlargement of many figures, such as those of the lumbar (Figs. 65, 69) and of the caudal vertebræ (Figs. 79, 81), seems to us uncalled for.

Aside from the remarks on the human skeleton, almost the whole volume is written in the spirit of pure descriptive anatomy, for, although the book purports to be among other things a preparation for comparative anatomy, information of a comparative nature seems almost studiously shunned. Thus, in describing the ossification of the occipital bone, the statement is made that it arises from four parts, but not the least intimation is given that these parts are the real bony elements separate in most vertebrates and fused in the higher mammals to form the occipital bone. Other complex bones, like the innominate, etc., are scarcely better treated. Some idea of the author's conception of comparative anatomy may be gained from the statements on page 596, where the names of the carpal bones are arranged in three columns, according as they are employed by American anatomists, European anatomists, and comparative anatomists; the last, according to their column, have not as yet discovered the pisiform bone. Notwithstanding that the author chooses to ignore the many pertinent and well-established facts of comparative anatomy, he indulges without any apparent reason in a discussion of seventeen pages on the evolution of mammalian teeth, a discussion which presents only one side of an extremely complex question and which in reality is largely made up of quoted extracts from the later writings of the author's celebrated townsman, Professor Cope. Why the teeth rather than other parts should have been taken for comparative treatment is not clear. On the whole, the way in which the author chooses to deal with the comparative side of his subject is perhaps the least satisfactory aspect of the volume.

The intention that the book shall be used by those preparing for medicine has led the author to devote considerable space to the relations of the bones in the human skeleton to those in the cat. In most instances these comparisons are in every way commendable, but in one or two cases they seem to us misleading. The sphenoid bone in man is known to be formed by the fusion of some eight elements, all of which may exist as separate bones in the lower vertebrates. In the cat these sphenoid elements are not united to form a single bone, as in man, but fuse into two distinct groups, the posterior of which usually unites with the occipital bone. The cat, therefore, does not possess a sphenoid bone, though, like many other vertebrates, it has the elements out of which one might have been formed. It is to be regretted that descriptive human anatomy has so biased the author that he has been unable to appreciate this difference, but has ascribed to the cat a sphenoid which he then states is composed of two parts.

Notwithstanding what seem to us the shortcomings of the volume, the substantial body of facts which it contains will insure for it the respect of investigators, and while we do not anticipate its extensive use as a class book, we believe that it will find its way to the bookshelf of every working anatomist and to the laboratory table of many students. We need only add, in conclusion, that the publishers are to be commended for their excellent presswork and binding.

G. H. P.

Rabbit Anatomy.[1] — Dr. F. Clasen, whose article on the muscles of the shoulder and arm of the cat appeared some three years ago, has just published the continuation of his work on the corresponding parts in the rabbit. The article, which is illustrated by some ten clearly drawn figures, gives in a thoroughly satisfactory way the origin, insertion, form, and innervation of the muscles of the shoulder and arm as far as the elbow in the rabbit. It is concluded with a table, showing the innervation of the two dozen muscles described. The author reserved for a later publication the general conclusions to be drawn from his study of the shoulder and arm musculature. To teachers accustomed to use Krause's well-known book on the rabbit this article will be a welcome supplement for the parts under consideration.

G. H. P.

[1] Clasen, F. Die Muskeln und Nerven des proximalen Abschnittes der vorderen Extremität des Kaninchens: Nova Acta. *Abh. der kaiserl. Leop.-Carol. deutschen Akad. der Naturforscher*, Bd. lxix, Nr. 3, 1897.

Stomach Movements.[1] — One of the most interesting papers in the last number of the *American Journal of Physiology* is that by W. B. Cannon on the movements of the stomach studied by Röntgen rays. Animals, chiefly cats, were fed upon food containing a small amount of bismuth subnitrate, which, being opaque to the rays, brings the form of the stomach clearly to view and thus allows the movements of normal digestion to be observed with ease. The cardiac portion of the stomach acts as a reservoir, in which, however, salivary digestion probably goes on. The pyloric portion is the seat of continuous constriction waves, which course from near the middle of the stomach to the pylorus. These thoroughly mix the food with the gastric juice, triturate it, and at intervals discharge some of it into the intestine, this operation being kept up till the stomach is empty. A very remarkable condition observed was that the stomach movements were almost instantly inhibited whenever the cat showed signs of anxiety, rage, or distress — a practical hint as to post-prandial occupations.

G. H. P.

Paired Fins of Fishes.[2] — In the last number of the *Jenaische Zeitschrift*, Dr. H. Brans gives an exhaustive account of the innervation of the paired fins of selachians, holocephala, and dipnoi. About half the paper is taken up with detailed anatomical descriptions, the substance of which is clearly summarized in a concluding table. The remainder of the paper is devoted to a discussion of the origin of vertebrate extremities, in which the author defends with some show of reason Gegenbaur's archipterygium theory and attempts to refute the more usually accepted theory of the continuous lateral fin. The paper is refreshing in that its author claims that in the settlement of morphological questions comparative anatomy should have a hearing as well as embryology.

G. H. P.

Anatomy of Salpa.[3] — Dr. M. M. Metcalf has published as a "separate" a paper of some twenty-six pages on the eyes and subneural gland of Salpa. The histology and embryology of the eyes in

[1] Cannon, W. B. The Movements of the Stomach, Studied by Means of the Röntgen Rays. *The American Journal of Physiology*, vol. i, pp. 359, 382, 1898.

[2] Brans, H. Ueber die Innervation der paarigen Extremitäten bei Selachiern, Holocephalen und Dipnoern. Ein Beitrag zur Gliedmassenfrage. *Jenaische Zeitschrift*, Bd. xxxi, pp. 239, 468, 1898.

[3] Metcalf, M. M. The Eyes and Subneural Gland of Salpa. The Friedenwald Co., Baltimore, 1898.

the solitary and chain forms of Cyclosalpa are given in detail, and an account of the subneural gland in this genus is appended. The paper is an abstract of a dissertation accepted at Johns Hopkins University for the degree of doctor of philosophy. G. H. P.

Relationships of American and European Mammalian Faunas. — Mr. A. Smith Woodward concludes a most valuable *résumé* of the history of the mammalian fauna of Europe and America (*Natural Science*, May, 1898) with the following considerations as to the place of origin of the various elements in the two worlds. At the base of the Eocene it is evident that the faunas of the east and the west were essentially identical. As they are traced upwards they gradually diverge.

The first noteworthy difference is the great development of the Condylarthra in America, and the rise in the Eocene of the large specialized Amblypoda, of which only a single genus (Coryphodon) has been found in the corresponding fauna of Europe. On the other hand, the still larger hoofed animals of the sub-order Proboscidea seem to have originated in the Old World, and did not reach America until the late Pliocene.

The Perissodactyla — the tapirs, rhinoceroses, and horses — appear to have advanced on a parallel course on the two continents, though in America both the rhinoceroses and the horses became extinct at the close of the Pliocene, the former without acquiring the characteristic horn.

Among Artiodactyla, both the deer and pigs seem to have been approximately parallel in their development in both continents, only differing in some minor branches, which soon became extinct. The camels, however, are clearly American throughout, only wandering into the Old World by Asia in the Pliocene. It is almost equally probable that the oxen originated in the Old World.

Among Carnivora, the Creodonta are both American and European; but on the former continent they only pass upwards into the dogs (Canidæ), weasels (Mustelidæ), and the aberrant cats of the family Nimravidæ, while in Europe they are succeeded, not merely by these families, but also by the Viverridæ, Hyænidæ, Felidæ, and Ursidæ. The viverroids and hyænas never reached America, but the true cats and bears arrived on that continent at the close of the Pliocene.

Of the Primates, the primitive lemuroids appeared in the Eocene similarly on both continents; but in North America they soon became extinct, while in the Old World they were followed by the true apes, and still have some specialized survivors.

Embryonic Budding in Hymenoptera. — Mr. Paul Marchal has recently published in the *Comptes Rendus* of the French Academy a preliminary account of a peculiar method of a sexual reproduction. The chalcid parasite Encyrtus lays a single egg in each egg of the moth Hyponomeuta. Like other chalcid eggs, this is at first surrounded by a cellular envelope; the cells of this multiply rapidly and develop into a long epithelial tube within the parasitized egg. The egg proper divides, and the divided portions separate, each one giving rise to an embryo, so that from one egg from fifty to one hundred embryos arise, lying like a chain in the epithelial tube, each of which gives rise to an Encyrtus like the parent. The author is at a loss to suggest a parallel to this method of reproduction among the Metazoa. The case of Lumbricus, as first described by Kleinenberg, at once suggests itself; and then there is that interesting case described by Agassiz in his "Methods of Study in Natural History," according to which the egg of our common sea snail Natica undergoes its third segmentation, and then from each of the resulting eight cells an embryo develops. Has any one yet confirmed this observation, or, if it be erroneous, has any one explained how the mistake arose?

The Cyclostome Pronephros. — In spite of the enormous literature on the pronephros, there are yet many points of fundamental importance unsettled. The recent papers of Rabl, van Wijhe, Felix, Field, Semon, and Price show many points of difference and few of agreement. The latest paper to come to our notice is that by S. Hatta (*Annotationes Japonica*, vol. i, 1897), upon the pronephros of the lamprey. Hatta claims that both the pronephric tubules and the pronephric duct arise from the region of the unsegmented mesoderm, but that the tubules at first correspond to the more dorsal segments. At most but six pairs of pronephric tubules are formed, the first and second of these in the segments where the posterior gill-slits later appear. These tubules, together with the sixth, disappear. Hatta regards these tubules as homologous with the Nierencanälchen of Amphioxus.

Marine Character of African Lake Fauna. — Mr. J. E. S. Moore recently read a paper before the Royal Society upon the results of his studies of the invertebrates of Lake Tanganyika, Africa. He points out that the fauna of this lake is strikingly unlike that of the other African lakes, Nyanza, Shirwa, and Kela, and that it has a facies peculiarly marine and of deep-sea forms at that. His conclu-

sion is that the easiest explanation of these facts would be to regard this lake as having been a deep arm of the sea at least as late as tertiary times, and that its animals are the descendants of a former marine fauna. The delicate nature of the medusæ of the lake, and the fact that its molluscs are deep-water forms, renders it impossible that they have migrated into the lake under existing conditions.

The Species of Millepora. — Thirty-nine so-called species of Millepora, the stag-horn coral, have been described from the seas of the world. Dr. Hickson, of Manchester, read a paper at the meeting of the Zoölogical Society of London, on April 5, in which he stated that the characters hitherto used for the discrimination of species have proved of no value, and it is believed that but one species exists, the various forms being due to the conditions under which the individuals lived.

Centrosome in Myzostoma. — Kostanecki has recently investigated the early phenomena of the egg of *Myzostoma glabrum* (*Arch. mikr. Anat.*, Bd. li). The most important statement made is that the centrosomes of the first cleavage spindle arise, as in other Metazoa, from the male centrosome, a result in conflict with Wheeler's previous studies.

Hermaphroditism of Crepidula. — Prof. E. G. Conklin, who has long been studying the embryology of Crepidula, concludes that this genus affords another case of protandric hermaphroditism and of marked sexual dimorphism.

Palæospondylus. — A few years ago Dr. R. H. Traquair described under this name a small fossil from the rocks of Scotland, which he regarded as a fossil cyclostome. Dr. Bashford Dean concluded a little later that a specimen in his possession showed traces of paired fins, a fact which threw doubts upon its cyclostome affinities. Dr. Traquair replied to the effect that the markings around the fossil, regarded by Dr. Dean as indicating the existence of paired fins, were due to inorganic agencies. At the meeting of the Zoölogical Society of London, on April 19, Dr. Dean presented a paper supporting his views, while Mr. A. Smith Woodward, the eminent authority on fossil fishes, stated that he was inclined to agree with Traquair in his interpretations. The question is one of great interest, and the last word has yet to be said upon it.

BOTANY.

The Ninth Report of the Missouri Botanical Garden. — It is doubtful whether the word "report" best describes the annual collection of original papers issued from the Missouri Botanical Garden. It is true each volume is prefaced by a brief statement of the financial condition, chief expenditures, and general progress of the Garden, but the body of the present "report," like most of its predecessors, is made up of articles upon research work, in fact of *acta*, a term for which, unfortunately, the English language possesses no very satisfactory equivalent. The more important events in the development of the Garden, during 1897, have been the erection of a new range of greenhouses; the acquisition of 2½ acres of additional land, and the purchase of the Redfield, Joor, Jermy, and Boehmer & Ludwig herbaria, together making an increment of about 30,000 specimens to the already extensive herbarium of the Garden. A peculiar feature in the report is an attempt to give a money valuation to the specimens in the herbarium, the value fixed upon being 10 cents per mounted sheet. This, it is true, approximates the ordinary commercial rate for recent collections, but in large and well-organized herbaria, in which considerable groups of plants have received expert identification of monographers, and many are, as Dr. Gray used to say, "embalmed in synonymy," it would certainly seem that the value, if given at all, might fairly be placed at a considerably higher figure. The growth of the library of the Garden has been even more remarkable than that of the herbarium, since no less than 7756 books and pamphlets have been secured during 1897.

The principal scientific papers in the report are: "A revision of the American Lemnaceæ occurring north of Mexico" (already noticed in these pages), by C. H. Thompson; "Notes upon *Salix longipes* Shuttl. and its relations to *S. nigra* Marsh.," by Dr. N. M. Glatfelter; "Revision of the genus Capsicum," by H. C. Irish; "List of cryptogams collected in the Bahamas, Jamaica, and Grand Cayman," by Prof. A. S. Hitchcock; "*Agave Washingtonensis* and other Agaves flowering in the Washington Botanical Garden in 1897," by Dr. J. N. Rose; and "The species of Cacti commonly cultivated under the generic name Anhalonium," by C. H. Thompson.

Especially noteworthy among these papers is Mr. Irish's monograph of Capsicum. An intensive examination of this well-known genus (which yields the various forms of red pepper known as

Cayenne, Chilli, Tabasco, etc.) was begun many years ago by Dr. E. Lewis Sturtevant, of Framingham, Mass; but owing to ill-health he was obliged to relinquish the work. Accordingly, with the gift of his noble collection of prelinnæan herbals, he sent to the Missouri Botanical Garden in 1892 his notes upon and specimens of the genus Capsicum. The task of shaping these materials into a final monograph has been a difficult one, and through some changes in the corps of herbarium assistants its completion has met with much delay.

The extreme variability in the forms of Capsicum led even in prelinnæan times to the characterization of a great number of species, and during the last century and a half more than 150 species and botanical varieties have been described and named, to say nothing of numerous lesser variations designated as horticultural forms. However, Mr. Irish is wisely conservative in his botanical treatment, recognizing but two species, *C. annuum* and *C. frutescens*. Of these the former exhibits much the greater variability and in the present treatment is divided into some twelve botanical and fifty-five horticultural varieties, many of which are figured. The extensive bibliography and the complex synonymy of these forms are cited with great fullness and detail. B. L. R.

Sur le genre Simmondsie.[1] — The shrubby monotype *Simmondsia californica* Nutt. has long been placed among the Buxaceæ. It inhabits arid regions in Southern and Lower California, and by the Spaniards is called *jojoba*. Economically it is notable for its large embryos, which, when removed from the seed-coats, are edible and nutritious in the manner of almonds. Without recognizing its identity with Nuttall's Simmondsia, Dr. A. Kellogg once described the plant as a Galphimia, but this was a mere guess at its affinity. Other botanists, who have dealt with its classification, have until now agreed in referring it to the box tribe of the Euphorbiaceæ or to the Buxaceæ, if that group is separated as an independent family. However, on the basis of morphological and anatomical investigations Professor Van Tieghem now expresses the belief that its affinities are rather to be found among the Chenopodiales, and furthermore that it is best regarded as the type of a distinct family, the Simmondsiaceæ, to be placed next the Tetragoniaceæ. The chief reasons assigned for the separation of Simmondsia from the Buxaceæ are the peculiar structure of the stem (in which successive

[1] Van Tieghem, Ph. *Journal de Botanique*, vol. xii, pp. 103–112.

fibro-vascular zones arise from the pericycle), the diœcious flowers, pentamerous calyx, absence of corolla, indefinite stamens, solitary ovules, apical position and caducous character of the stigmas, exalbuminous seeds and accumbent cotyledons. Several of these features, however, do not appear to have in the present case much diagnostic value. For instance, nothing can be argued from the absence of petals, since these members are either lacking or extremely rudimentary in the other Buxaceæ. As to the indefinite stamens, these occur also in Styloceras, which is furthermore subdiœcious. Nevertheless, enough good distinctions remain to show a rather wide gap between Simmondsia and the other genera of the group to which it has long been referred.

The tendency to make new families of divergent or anomalous genera is of late very pronounced. Thus, in the interval between the issue of Engler & Prantl's *Natürlichen Planzenfamilien* and the supplement of the same work, a rather large number of these small and often monotypic "families" have been suggested. The creation of such families, if followed by no rearrangement, is of doubtful practicality, and likely to complicate rather than to clarify classification. It is otherwise, of course, in cases like the present, where a composite group must be divided in order that its parts may be more naturally distributed in relation to allied families.

B. L. R.

Contact Irritability in Hook Climbers.[1] — In this article Dr. Ewart gives an exhaustive account of the phenomena of contact irritability presented by certain tropical hook climbers which he investigated at Buitenzorg. Treub was the first to call attention to the fact that the hooks of certain climbing plants thickened and became stronger when fixed to some support. His work having been mainly morphological, Dr. Ewart has taken up the physiological aspect of the question.

This involved the consideration of the effect of variation in the intensity of the stimulus applied; of the transmission and ultimate effect of such stimuli on the growth of the parts concerned. The stimulus afforded the plant under its natural condition, that brought about by the usual artificial mechanical devices, and, in addition, the stimulation caused by injury, all received attention. The reaction is observable in the inequilateral increase of growth of the hooks,

[1] Ewart, A. J. Contact Irritability. *Ann. du Jard., Bot., de Buitenzorg*, vol. xv, i, pp. 187–242.

and the results are tabulated in measurements of various parts of these organs.

Dr. Ewart finds that in a purely physiological sense a series of connecting forms exists between the simpler forms of climbing hooks as seen in *Uncaria* and the highly specialized tendrils of the *Passiflora* type. The simplest type of all is represented by the hooks in *Cæsalpinia*, *Rubus fruticosa*, etc., where their use in climbing is purely accidental, in consequence of which fact they do not thicken on contact. Next in the series comes *Luvunga*, possessing non-irritable spines and irritable climbing hooks, followed by the type represented by *Uncaria* and *Artrabotrys*, where only the irritable clasping hooks are found. In his work only the last two were experimented with. Next in order come forms like *Roncheria* and *Ancistrocladus*, where, besides the thickening, the sensitive region shows a slightly increased curvature produced by contact alone. Finally, in forms represented by the root tendrils of *Vanilla*, tendrils of *Cucurbita*, *Passiflora*, *Sicyos*, etc., is presented the phenomenon of rapid and, at first, transient curvature by contact alone. In such cases it is the alteration in the turgidity of the parts that effects the change.

Dr. Ewart goes on to say that no hard and fast line can be drawn between a mere contact and a pressure stimulus. Irritable hooks are adapted to respond to pressure more readily than do tendrils, the latter being affected to a greater degree by contact. In certain cases at least, pressure and traction stimulate cambial activity corresponding to the mechanical requirements of such cases. Contact stimuli appear to affect only the outer layer of cells directly, the curvature resulting being due to the transmission of an impulse. The weak stimulus afforded by injury to the parts concerned is probably to be explained by the normal increase of activity, a kind of tissue pyrexia, which is known to follow wounding.

In cases where the curvature is slowly produced, as in Strychnos, the change cannot be due to any alteration of turgidity but to an heterauxesis in the cambial growth.

Irritable hooks and tendrils, regarded in analogy with other irritable organs, are parts which respond as a whole when any portion of them is stimulated, the result varying, of course, with the point of application and the nature of the exciting stimulus. In conclusion, the author says that the irritation caused by contact stimulus, in the strict sense, is limited almost wholly to the concave surfaces of the hooks. When the pressure is increased to bring about an internal mechanical strain, a response is eventually to be noticed, but

not so quickly nor to such an extent as under normal conditions of contact.

The plants experimented with chiefly were: *Uncaria sclerophylla, Ancistrocladus Vahlii, Roncheria Griffithiana, Artrabotrys Blumei, Strychnos monospermum, S. laurina, Amphilobium mutsii, Bauhinia tomentosa, Dalbergia linga,* and *Vanilla aromatica.* H. M. R.

Apogamy in Ferns.[1] — A considerable series of cultures under varying conditions show that some, at least, of the conditions which induce apogamic development in fern prothalli are a deprivation of water sufficient to prevent the possibility of fertilization and the action of direct sunlight. Different degrees of apogamy are possible, from a cylindrical process still bearing sexual organs arising from the apex of the prothallus, to the condition where this process gives rise directly to the vegetative bud of the sporophyte.

While the authors admit that, with certain assumptions, the theory of antithetic alternation, as advanced by Bower, affords a satisfactory explanation of the relation of the gametophyte to the sporophyte generation, they are inclined to favor more the idea of homologous alternation, namely, that the sporophyte arose gradually from modifications of individuals resembling the sexual plant, and is not from a mere elaboration of the zygote. The line of evidence offered bears on the assuming of a terrestrial habitat by originally aquatic plants, whereby these plants, in adapting themselves to dryer surroundings, are forced to develop in the line of the production of dry reproductive cells (spores) rather than the more sensitive sexual organs. Hence the increase in size and importance of the spore-bearing plant, which eventually, by its own mass of vegetation, would afford shade, and consequently the conditions more suitable for the persistence of the primitive moisture-loving sexual stage.

The authors conclude by saying that the question is still an open one and must remain so until more decisive evidence is brought forward by which either the theory of homologous alternation or that of antithetic alternation can be shown to be untenable. H. M. R.

A New Method for Preserving and Fixing Fresh-water Algæ.[2] — This fixing agent consists of equal volumes of formalin, pyrolignic acid, and methyl alcohol. The algæ are drained as far as is possible, without injury to them, from the water in which they grow, and

[1] Lang, W. H., and Clark, G. H. On Apogamy and the Development of Sporangia upon Fern Prothalli, *Bot. Centralblatt,* Bd. lxxiv, Nr. 3, p. 72.

[2] Pfeiffer, Oesterreicher. *Bot. Zeit.,* Bd. xlviii, Hefte 2 und 3, 1898.

placed directly in a quantity of the solution, which should be at least equal in volume to the mass of algæ taken. They will keep in this way indefinitely. When it is desired to use the material it may be washed in several changes of water to which some antiseptic agent has been added or in a 10% solution of glycerine. For sectioning in paraffin the specimens are treated in the ordinary way with various grades of alcohol. The author also recommends certain special carmine stains.

H. M. R.

Sunstroke and Bacteria. — From *Natural Science* (May, 1898), we learn that Dr. Lugur Sambon claims to have shown that under the term sunstroke are included two entirely different things: that many reported cases are due only to syncope, and when these are eliminated there remains a thermic fever to be attributed to a specific organism. He shows that the disease possesses definite symptoms and has a definite geographical distribution. That heat is not the cause is evidenced by the fact that people in certain regions, or under artificial conditions, work in temperatures far higher than exist in places where sunstroke frequently occurs, without suffering from the disease. Thus, true sunstroke is absent from the dry plains of Colorado, as well as from the high central plateau of India, while it is common in the moister climate and lower temperatures of the Mississippi Valley and the Atlantic coast of America, as well as on the low-lying plain of the Ganges. It also frequently occurs with great fatality in hospitals. He compares the bacterium with that of tetanus, and considers that it lives in the soil and is carried into the system with dust, and there forms the toxic poison, which is the real cause of death.

PETROGRAPHY.

The Igneous Rocks of the Boston Basin are again the subject of petrographic study. White[1] finds among them granites, diorites, quartz-porphyries, felsites, melaphyre, and diabases. The last two-named rocks occur as dikes. The melaphyre is an altered basalt, constituting a flow which is amygdaloidal at its upper surface. The quartz-porphyries appear to be regarded as a peripheral phase of granite, and the felsites as a surface facies of the same rock. Both

[1] *Proc. Bost. Soc. of Nat. Hist.*, vol. xxviii, p. 117.

the porphyry and the felsite are called aporhyolites by the author, though he does not attempt to prove that their present features are due to the devitrification of an ancient glass. The granites comprise four types, distinguished as dioritic and hornblendic granites, granitite and hornblendic diorite. Nearly all these rocks had already been described by earlier writers. White adds a few points of interest concerning them.

The Eruptive Rocks of Mexico. — Harrington [1] gives a *résumé* of an article by Ordoñez, in which are described briefly the eruptive rocks of Mexico. The precretaceous eruptives are principally granites, associated with sedimentary rocks, and sometimes with younger rhyolites and andesites. With the cretaceous age began a great series of eruptions whose products were granites, granulites, syenites, diorites and diabases, and the "greenstones" characteristic of the mining districts. Among these latter are andesites, green dacites, trachytes, rhyolites, labradorites, and basalts. The rhyolites of Chichindaro, of San Ildefonso, of Tula, of Hidalgo, and a few other places are sphemlitic. Some of the modern volcanoes erupt andesites, and others trachytes. Many of the trachytes contain olivine, and occasionally these rocks grade into typical basalts. Labradorites are also common lavas. They differ from basalts in containing but little, if any, olivine.

The Gneisses of Anglesey, England. [2] — The gneissic series of Anglesey, England, comprises plutonic rocks that have suffered crushing and shearing subsequent to their consolidation. The banded gneisses were formed from a complex of diorite and felsite, or from felsite whose secondary structure has been accentuated by the infiltration of dark-colored minerals along the cleavage planes. The normal gneisses of the district were formed from granite, diorite, or felsite. The hälleflinta, so frequently mentioned in the literature of the district, is a partially altered felsite.

Syenite Porphyries of the Lake Champlain District. — In the pre-Potsdam area of Clinton County, N. Y., Cushing [3] finds a series of dikes, composed of a basic rock which is classed as syenite-porphyry. This rock consists of a microperthitic intergrowth of albite and orthoclase, biotite, magnetite, hematite, hornblende, quartz, albite,

[1] *Journ. of Geol.*, vol. v, p. 466.
[2] *Quar. Journ. of Geol. Soc.*, vol. liii, p. 349, 1897.
[3] *Bull. of Geol. Soc. of Amer.*, vol. ix, p. 239.

orthoclase, microcline, apatite, and sphene, with secondary chlorite, calcite, muscovite, epidote, and hematite. The microperthite and usually the biotite are in phenocrysts, the remainder of the minerals constituting a groundmass with the trachytic structure. The most basic of the dikes has the following composition:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO_2	CaO	MgO	K_2O	Na_2O	P_2O_5	Cl	F	Loss	Tot.
52.53	18.31	.34	6.43	.15	3.15	1.82	6.47	7.26	1.59	.40	.32	1.16	= 99.93

The magma from which the dike material was produced belongs to the foyaite type. The most acid of the dikes are syenite porphyries; the most basic are types of a rock that would seem to be too basic to be included in this group.

A Study in Weathering. — An interesting study of weathering has recently been made by Smyth,[1] his subject being the dike of alnoite at Manheim, N. Y. The fresh rock, which is black, consists largely of biotite, and serpentine derived from olivine, and of some magnetite, apatite, perofskite, and secondary calcite. Its weathered product is a soft golden-brown clay-like mixture of bleached mica, magnetite, perofskite, probably apatite, and some very fine-grained material of uncertain nature.

Analyses of the fresh and the weathered rock calculated to 100 per cent, and the proportion of loss for each constituent are:

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	K_2O	Na_2O	Ign	Tot.
Fresh	35.51	2.27	6.14	8.59	5.64	20.55	7.46	2.90	.71	10.23	100
Weathered	33.40	2.93	7.95	16.86	1.49	13.54	5.30	.29	.23	18.01	100
Loss	27.31	.00		3.70		48.97	45.10	92.27	74.97	.00	

About 27 per cent of the original rock has been removed by solution, causing its complete disintegration, and yet a great portion of its original components can be detected in its weathered product.

Notes. — Hopkins[2] describes the brownstones of Pennsylvania from the economic standpoint. He gives a brief account of the microscopic structure of thin sections of the product of each of the working quarries in the state.

Although the liebenerite-porphyry of Predazzo has long been regarded as a rock derived from some nepheline-bearing porphyry, no rock containing nepheline had been found in the Predazzo district

[1] Smyth, Jr., C. H. *Bull. Geol. Soc. of Amer.*, vol. ix, p. 257.

[2] Appendix to *Ann. Rep. Penn. State College*, for 1896.

up to within a few years past. Osann and Hlawatsch [1] now report the existence of blocks of a porphyritic rock in the Viezzena valley, in whose hand-specimens phenocrysts of sanidine are plainly evident. In the thin section, phenocrysts of orthoclase, microcline, plagioclase, pyroxene, hornblende, mica, and garnet are in a holocrystalline groundmass composed of feldspars, nepheline, sodalite, and various secondary products. The authors call the rock a nepheline-syenite porphyry. It differs from the original of the liebenerite-porphyry in containing no nepheline phenocrysts.

On the contact of a hauynophyre dike with limestone near Horberich, in the Kaiserstuhl, Brauns [2] finds a contact rock that is very unusual in composition. It consists of melanite, calcite, augite, gehlenite, hauyn, apatite, and mica. The gehlenite is in well-defined crystals, intergrown with the calcite, garnet, and the hauyn. The hauyn, melanite, and augite are thought to have been derived from the volcanic rock, and the gehlenite to be a result of the contact action.

A few volcanic rocks from the Baluchistan-Afghanistan boundary have been submitted to McMahon [3] for study. He finds among them andesites, basalts, a granite, a quartz-syenite, various acid lavas, pumice, tuffs, and a few sedimentary rocks. The phenocrysts in the andesite are oligoclase and andesine, the former predominating. Three of the andesites contain anthophyllite; and one, an augite hornblende-andesite, contains phenocrysts of olivine.

The lava [4] of Mt. Edgecombe, Krusov Island, Alaska, is an hypersthene-andesite composed of two generations each of plagioclase, hypersthene, augite, and magnetite.

Cross [5] reports the existence of another volcanic rock containing analcite. The rocks form a small outcrop in "The Basin," about twelve miles west of Cripple Creek, Colo. It is a basalt, composed of the usual constituents of basalt, to which are added large and small colorless grains of analcite. Analysis of the separated analcite yielded:

SiO_2	Al_2O_3	Fe_2O_3.FeO	CaO	SrO	MgO	K_2O	Na_2O	K_2O	Tot.
51.24	24.06	1.20	1.62	.06	.33	1.25	11.61	9.09	= 100.40

The analysis of the rock shows it to be very closely allied to the monchiquites of Rosenbusch.

[1] *Min. u. Petrog. Mitth.*, vol. xvii, p. 556.
[2] *Bericht. Oberhess. Ges. f. Natur. u. Heilk.*, 1898.
[3] *Quar. Journ. of Geol. Soc.*, p. 289, August, 1897.
[4] Cushing, H. P. *Amer. Geol.*, p. 156, September, 1897.
[5] *Journ. of Geol.*, vol. v, p. 684, 1897.

GEOLOGY.

Lavas and Soils of the Hawaiian Islands.[1] — The rocks of the Hawaiian Islands, with the exception of limited accumulations of coral and calcareous sands and a "remarkable felspathic andesite" reported by Dana, are basaltic lavas. The surface lavas have been changed to soil by two processes: first, by the action of heated vapors charged with sulphuric acid; and, second, by the normal processes of weathering.

The vapors now escaping through fissures over large areas within the crater of Kilauea at times contain as high as 4.92 per cent of sulphuric acid, and ranging in temperature from the lowest to the last point of condensation. In many instances the walls of the fissures, through which the acid-laden steam escapes, are luminous with heat at night. Marked chemical changes in the rocks are in process about these solfataras, and similar alterations have been observed at a distance from recent volcanic activity, where "poison soils" prevent the growth of vegetation.

The sulphurous vapors, acting on the heated basalt, disintegrates it, changing the lime into gypsum, the aluminum and alkalies into alum, and the iron into the ferrous sulphate. These products separate out in distinct masses, and impart to the soil various colors and properties. The iron, upon exposure to the air, changes to the hydrous ferric oxide, and gives rise to laterites.

Geologically, the soils are classified into three types:

1. *Dark Red Soils:* Those derived from normal basalt by simple weathering in a hot, dry climate, — the red color being imparted by the anhydrous ferric oxide. They are the most fertile soils.

2. *Yellow and Light Red Soils:* Those derived from lavas, which were first altered by the action of sulphurous vapors, and subjected to subsequent weathering in a humid climate. The color is due to the hydrated ferric oxide. As a type they are generally lacking in fertility.

3. *Sedimentary Soils:* Those produced by disintegration of lava at high elevations, and then subsequently removed by rain-wash and streams to lower and flatter lands.

When compared with the glacial soils of America, the soils of the

[1] Maxwell, Walter. Lavas and Soils of the Hawaiian Islands. Investigations of the Hawaiian Experiment Station and Laboratories [Established by the Hawaiian Sugar Planters Association], pp. 1–186, map and four plates. Honolulu, 1898.

Hawaiian Islands show some remarkable peculiarities. They are of recent origin, are strongly basic in character, being composed largely of silicates soluble in acids. The leaching processes, to which they have been subjected, has removed in great measure the acidic constituents. The glacial soils of America, on the other hand, are derived from ancient rocks, and are composed largely of silicates insoluble in acids. The basic constituents have been largely removed by prolonged weathering, and the soils differ markedly from the rocks from which they were derived.

The soils of the Hawaiian Islands are classified by Maxwell, according to the climatic conditions under which they originated, as follows:

1. *Upland Soils:* Those formed under low temperatures and large rainfall.

2. *Lowland Soils:* Those formed under high temperature and small rainfall.

From analysis made on a large number of samples of these soils, it appears that those of the first class contain a large per cent of organic matter and nitrogen, while the elements of plant food have been largely removed by leaching; and that the soils of the second class have a low content of organic matter and nitrogen, and a high percentage of plant-food elements in an available state. These differences are due to the fact that the lowland soils receive the surface waters from the upland soils.

In determining the availability of the food supply of the soils, the author assumed that the amount removed by cropping added to the amount carried away by drainage waters equaled the total available supply. From a large number of analyses made of the waters and of agricultural products, it was found that the amount of the various elements carried away from the soil by the drainage waters equaled the amount of similar elements removed by cropping. By a series of experiments to ascertain the action of organic acids of various degrees of concentration on the different soil constituents, it was found that aspartic acid dissolved the essential plant-food materials in approximately the same proportions as they were found in the drainage waters. Furthermore, it was found that a one-per-cent solution of this acid removed the same amounts of these materials in twenty-four hours as ten crops of sugar cane; hence it was concluded that one-tenth of the amount of lime, phosphoric acid, and potash removed from a soil by a one-per-cent solution of aspartic acid in twenty-four hours is the available supply of that particular soil.

A special feature of this highly instructive report is the large number of analyses of rocks, soils, and water which it contains. It is unfortunate, however, that a more definite discrimination is not made between observed facts and hypotheses. An analytical table of contents and an index, both of which are absent, would have greatly enhanced the value of the report.

SCIENTIFIC NEWS.

THE tenth congress of Russian naturalists and physicians takes place this year at Kieff, August 21–30, under the presidency of Prof. J. Rachmaninoff.

Dr. Franz Ritter von Hauer, for several years intendant of the Hof Museum of Vienna, has been retired.

The British Association for the Advancement of Science will hold its meeting for 1899 at Dover, from September 13–20, probably under the presidency of Prof. Michael Foster. The French Association will meet at about the same time on the opposite side of the channel, at Boulogne, so that visits can be exchanged between the two associations. The place of meeting in 1900 has not yet been decided; possibly it will be at Bradford. In 1901 the meeting will be held in Glasgow.

Dr. William T. Brigham has been appointed director of the Berenice Panahi Bishop Museum at Honolulu, H. I. A large addition is to be made to the museum building.

The sixty-ninth anniversary meeting of the Zoölogical Society of London was held April 11, 1898. From the reports we extract the following items. At the close of the year the number of fellows was 3158; the income fo the year was nearly £29,000; and the library contained over 20,000 volumes. Three new buildings were opened to the public. The society met with a serious loss in the death of A. D. Bartlett, for 38 years superintendent of the gardens. His son, Clarence Bartlett, was appointed to the position. The visitors to the garden in 1897 were 717,755, and the number of animals on exhibition was 2585, about half of these being birds. The election of officers for the ensuing year resulted as follows: President, Sir W. H. Flower; secretary, P. L. Sclater; treasurer, Chas. Drummond; members of council, F. E. Beddard, W. T. Blanford, R. Lydekker, H. Saunders, and C. S. Tomes.

The German Society of Anatomists held its twelfth annual meeting at Kiel, April 17–20, 1898. Among the papers read were the following: Pfitzner, on brachyphalangy and related questions; Barfourth, artificial production of spina bifida in Amphibian larvæ; Unna, the

fat of dermal glands; van Wijhe, the contribution of the ectoderm to the pronephric duct; Rabl, the non-contribution of the ectoderm to the pronephric duct; Bethe, primitive fibrillæ in the ganglion cells and nerve fibres of vertebrates and invertebrates; H. Virchow, surface views of selachian embryos and the region of mesoderm formation; Kopsch, experimental researches on the primitive streak of the chick — similar developmental forms in vertebrates and invertebrates; Reinke, direct cell division and degeneration of the nucleus in liver cells; Meves, spermatogenesis in mammals; Osarva, position of Hatteria in the system; Lenhossek, new centrosomal discoveries; van der Stricht, nucleus of Balbiani; Rabl, anatomy and structure of the lens; Mollier, mechanics of the shoulder girdle; Kolster, Mauthner's fibres in teleosts; Kölliker, dilator pupillæ in white rabbits — primitive fat organ in young mammals — striped muscle in the ligamentum-uteri steres — structure of the ovary in the horse; Gaupp, primordial cranium in Lacerta agilis; Braus, extremities of selachians; Ravn, allantoic stalk of the chick; Klaatsch, tentacle apparatus of Amphioxus; Graf Spee, model of the youngest-known human embryo; Mitrophanow, gastrulation in amniotes; Broman, development of the ossicula auditus in man; Märtens, development of the larynx in the anura; Kallius, development of the larynx in man; Maurer, derivatives of the gill slits in lizards; Grönroos, primary germ layers in Salamandra; Benda, genesis of the spiral filament in the mammalian spermatozoön. The only American to join the society this year was Dr. R. G. Harrison, of Baltimore. The meeting next year will be held in Tübingen, at Whitsuntide.

Recent appointments: Rudolf Beyer, honorary professor of botany in Berlin. — Dr. Arthur Bornträger, director of the agricultural station in Palermo. — Dr. Emil Böse, of Karlsruhe, government geologist of Mexico. — Dr. Friedrich Moritz Brauer, director of the zoölogical collections in the Vienna Hof Museum. — Dr. Alessandro Coggi, of Bologna, professor of zoölogy, comparative anatomy, and physiology in the University of Perugia. — Dr. Giovanni Battista Condorelli, professor of natural science in the technical school at Gaeta, Italy. — Dr. Hanson Kelly Corning, extraordinary professor of anatomy in the University of Bern. — Pierre Fauvel, professor of zoölogy in the University of Angers, France. — Dr. Adriano Fiori, privat docent in botany in the University of Padua. — Dr. Bela Haller, professor extraordinarius of zoölogy in the University of Heidelberg. — Dr. Franz Hoffmann, privat docent for physiology in the University of

Leipzig. — Ludwig Kathariner, professor of zoölogy and comparative anatomy in the University of Freiburg, Switzerland. — Dr. F. L. Kitchen, paleontologist to the geological survey of Great Britain. — Oreste Mattivolo, professor of botany in the Instituto di Studi Superior in Florence. — Dr. Aladár Richter, privat docent for vegetable anatomy in the University of Budapest. — Dr. Domenico Sangiorgi, assistant in the geological cabinet of the University of Parma. — Dr. G. Adolf Sauer, extraordinary professor of geology in the University of Heidelberg. — Dr. Paul Schiemenz, director of the biological and fishery investigation station "Muggelsee," near Berlin. — Dr. J. L. C. Schroeder van der Kolk, professor of mineralogy in the Polytechnicum at Delft, Holland. — Dr. Eugenio Serra, assistant in the botanical garden at Palermo. — Dr. Franz Steindacher, intendant of the Natural History Museum in Vienna. — Dr. Johannes Thiele, of Strasburg, assistant in the zoölogical collections of the Agricultural School at Berlin. — Dr. A. Weberbauer, privat docent for botany in the University of Breslau.

Recent deaths: José d'Anchietá, zoölogist in Angola, Sept. 14, 1897. — Frederick Charles Aplin, ornithologist in Bodicote, England, aged 43 years. — Alphonse Briart, geologist at Mariemont, Belgium, March 15, aged 73. — Dr. Max Dahmen, bacteriologist, in Krefeld, Germany. — George Christopher Dennis, dipterologist, in York, England, December 22, aged 70 years. — Franz Fiala, botanist and archæologist, curator of the ethnological collections of the Museum of Bosnia-Herzegorina, at Sarajevo, January 28, aged 36. — Dr. K. B. Jacob Forssell, lichenologist, at Karlstad, Sweden, February 11. — Dr. Samuel Gordon, president of the Royal Zoölogical Society of Dublin. — Lieut. Charles Cooper King, geologist, in Camberley, Surrey, England, January 16, aged 55. — E. J. S. Linnarsson, botanist, in Sköfde, Sweden. — Emmanuel Martin, lepidopterologist, at Creil, France. — John Carrick Moore, geologist, in London, February 10, aged 94. — Alfred Monod, cryptogamic botanist, at Neuilly, near Paris, aged 61. — Dr. Guiseppe Palma, zoölogist, in Naples, January 18. — A. J. Horace Pelletier, student of injurious insects in Madon, France. — John Robert Streatham Hunter-Selkirk, geologist and antiquary at Braidwood, Scotland, March 23, aged 62. — Thomas James Stoller, geologist, at Evesham, England.

PUBLICATIONS RECEIVED.

BRITISH MUSEUM: List of the Types and Figured Specimens of Fossil Cephalopoda, by J. C. Crick. London, 1898. 103 pp., 8vo. — COPE, E. D.: Syllabus of Lectures on the Vertebrates, with an introduction by Henry Fairfield Osborn. Philadelphia, University of Pennsylvania, 1898. $1.00. — LANGE, D.: Handbook of Nature Study for Teachers and Pupils in Elementary Schools. Macmillan Co., 1898. xv-329 pp., 8vo. 60 wdcts. $1.00. — LØVENDAL, E. A.: De Danske Barkbiller (Scolytidæ et Platypodidæ Danicæ) og deres betydning for Skov-og Havebruget. — Kjøbenhavn: Det Schulotheske Forlag, 1898. 212 pp., 4to, 89 wdcts., 5 plates.

GAGE, S. H.: The Life History of the Toad, *Teacher's Leaflets*, No. 9, April, 1898. — WASHBURN, F. L.: Preliminary Report upon the Introduction of the Eastern Oyster to the Oregon Coast. 1898. 4 pp.

Annales del Museo Nacional de Montevideo. Tome ii, Fasc. viii, 1898. — *Bulletin Buffalo Society of Natural Sciences.* Vol. v, No. 5, 1897; Vol. vi, No. 1, 1898. — *Geographical Journal.* Vol. xi, No. 6, June. — *Knowledge.* Vol. xxi, No. 152, June. — *Linnean Society of New South Wales.* Abstract of Proceedings, April 27, 1898. — *Missouri State Horticultural Society.* Fortieth Annual Report. Jefferson, 1898. — *Modern Medicine.* Vol. vii, No. 5, May. — *Proceedings Natural Science Association of Staten Island.* Vol. vi, No. 17, May. — *Revue Scientifique.* Ser. 4, Tome ix, Nos. 22, 23, May and June. — *University of Wyoming.* Experiment Station. Bull. No. 36, April. — *Zoölogical Society of Philadelphia.* Twenty-sixth Annual Report.

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